Control your home climate with “Matter”

Energy transition stimulates next-gen HVAC systems

Presented by Murata and NXP

Today’s Presenters

Rui Ramalho
Product Manager
Connectivity modules

Murata Electronics

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Business Development Director
Wireless Connectivity

NXP Semiconductors

Presentation Overview

- Matter Introduction by NXP
- Introduction to Murata
- Murata wirelessly enables Smart Devices
- Q & A

RESIDENTIAL AND COMMERCIAL BUILDINGS ARE RESPONSIBLE FOR [6%-15%] GREENHOUSE GAS

Challenge of reducing the global footprint meanwhile population and temperature will increase

YoY Energy price inflation [5%-137%] iea.org
Change in Climate, Home, and Building control systems

Use of greener and cheaper sources of energy Seamless & Thinnest
control of energy consumption becomes the norm

Requirements for Smarter and interconnected systems

Standards Protocols for the smart home/building

Wi Fi™

Bluetooth®

zigbee

THREAD

Ecosystems

1997 1999 2004 2014 2016 2019

Matter Introduction

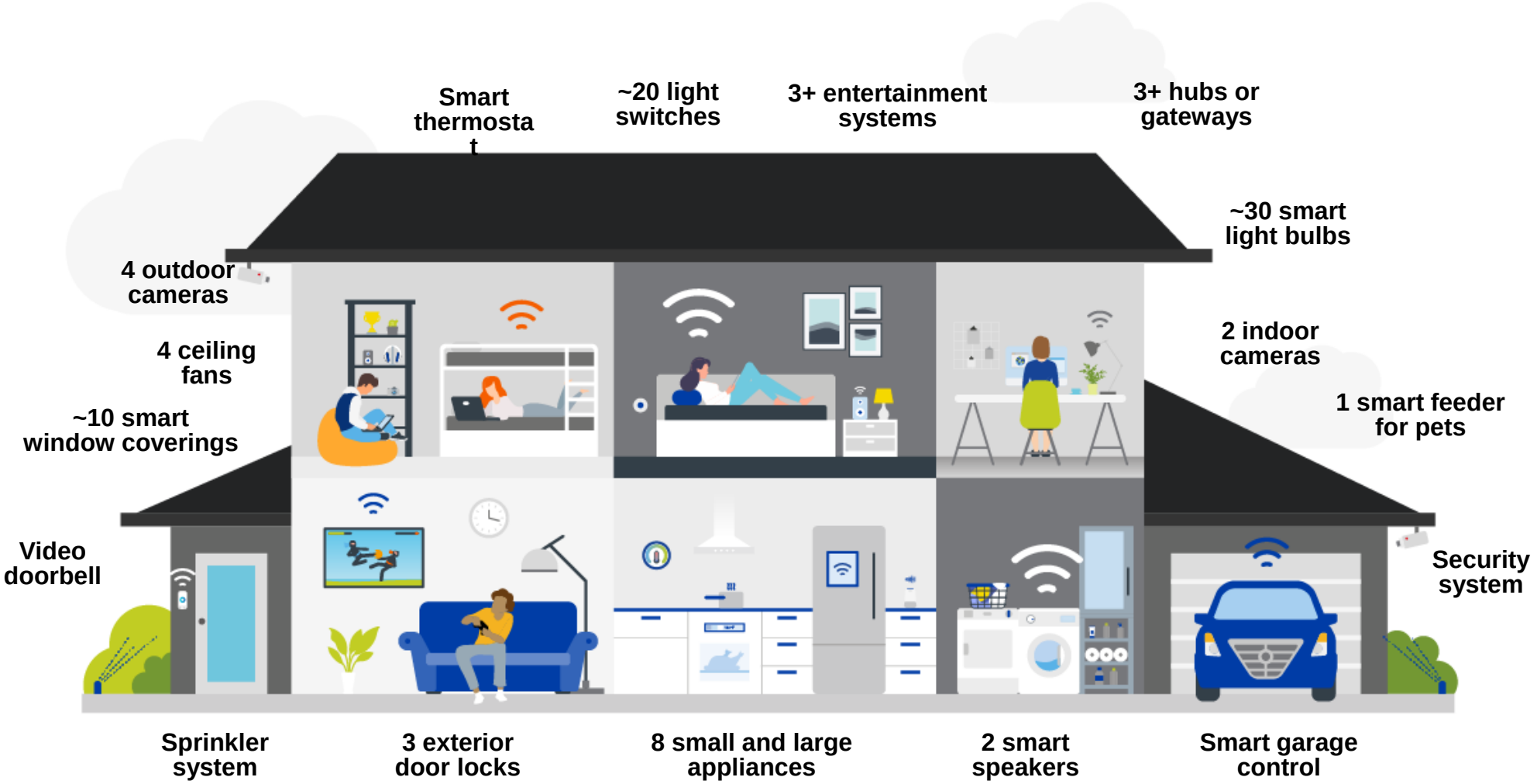
SECURE CONNECTIONS
FOR A SMARTER WORLD

SMART HOME INTEROPERABILITY CHALLENGE

100+
IoT devices

30+
protocols

Wired &
wireless



MATTER

A unified IP-based protocol to securely and robustly connect smart devices with each other, regardless of brand, and across smart home ecosystems

- Bring interoperability in Smart Home Ecosystem
- Increase reliability for consumers
- Ensure security and privacy
- Simplify development for “things”

Links:

Matter

NXP for Matter

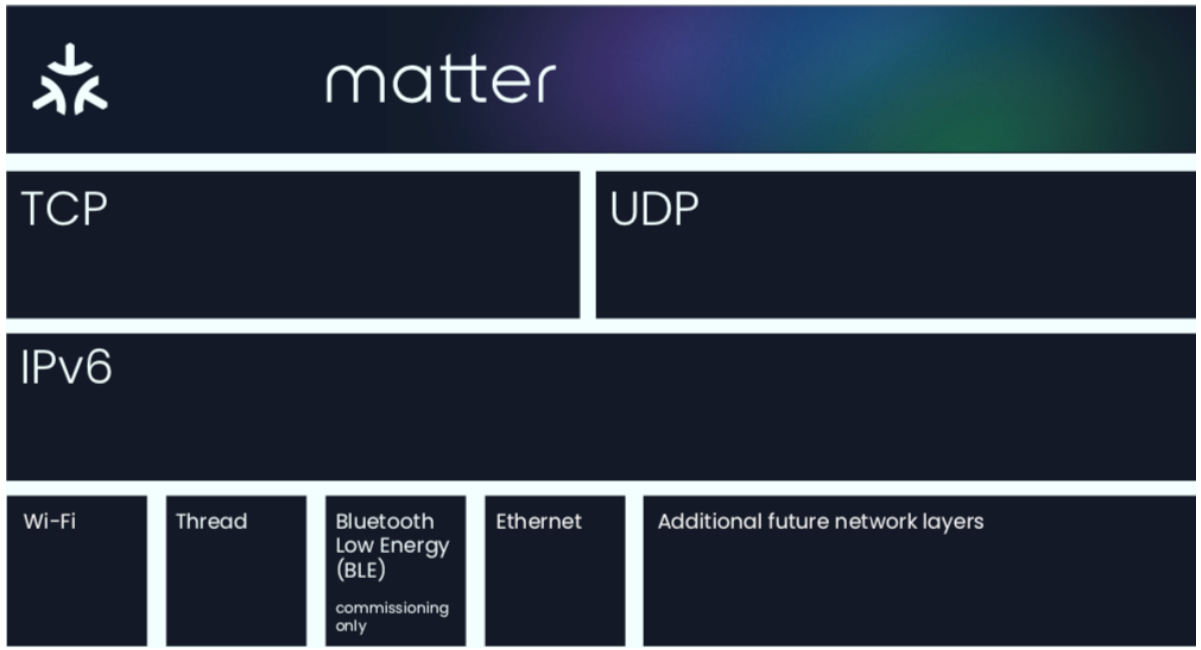
Led by global brands

And > 250 other companies!

csa connectivity standards alliance

amazon · ASSA ABLOY · COMCAST · Google · Haier · HUAWEI · IKEA · Infineon · Kroger · LATCH · LEEDARSON · legrand · LUTRON · Midea · NORDIC SEMICONDUCTOR · NXP · oppo · resideo · SAMSUNG · Schneider Electric · signify · SILICON LABS · somfy · life.augmented · Texas Instruments · tuya · Wulian

MATTER FOR IOT DEVICES



Local network to connect smart devices to each other across ecosystems

- Reliable network, doesn't depend on the cloud

IP-based connectivity specification

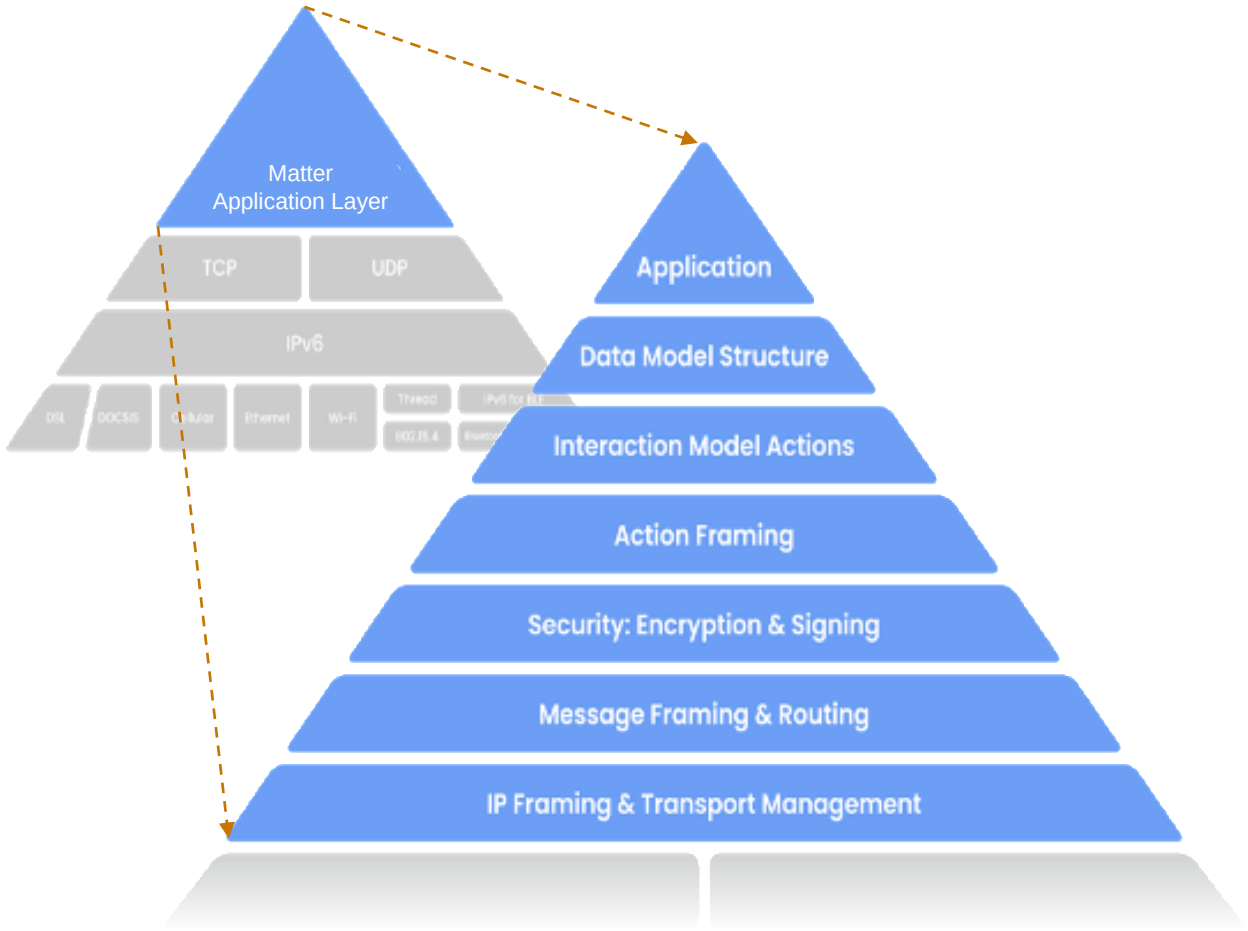
- Eliminates need for dedicated hubs, gateways and translators

Open, royalty-free standard, Open-Source software

Security & privacy as design tenets

Interoperability through certification

MATTER: SIMPLIFIED DEVELOPMENT



- **Standardization of lifecycle events**
  - Provisioning/onboarding, removal, error recovery, and software updates
- **Common application layer + data model**
  - Interoperability, simplified setup & control
  - Core operational functions, multiple device types
- **Secure**
  - AES-128-CCM encryption with 128-bit AES-CBC
- **Common protocol across device and mobile**
  - Extendible to cloud

DEVICES SUPPORTED BY MATTER 1.0/1.1

HVAC Controls

Safety and Security Sensors

Door Locks

Lighting and Electrical

Media Devices

Window Coverings & Shades

Controllers & Bridges

Matter 1.0 and 1.1 Specs

NOTE: Functions from several Matter Device Types can be combined to create a device with expanded functionality

Device Type	Application
Lighting and Electrical	Light (on/off, dimmable, color temperature, extended color)
Smart Plugs/Outlets and other Actuators	On/Off plug-in unit Dimmable plug-in unit Pump
Switches and Controls	On/Off light switch Dimmer switch Color dimmer switch Control bridge Pump controller Generic switch
Sensors	Contact sensor Light sensor Occupancy sensor Temperature sensor Pressure sensor Flow sensor Humidity sensor On/Off sensor
Closures	Door lock Door lock controller Window covering Window covering controller
HVAC	Heating/cooling unit Thermostat Fan
Media	Video player Basic video player Casting video player Speaker Content App Content video client Video remote control
Generic	Mode select

MATTER DEVICE TYPES IN DEVELOPMENT

Cameras

White Goods (Appliances)

Robot Vacuums

Energy Management

Air Quality Control

Smoke & CO Detection

Ambient Presence Sensing

Access Points

Evolving Matter

Bi-Annual Release Cadence

Future releases will cover

- Matter Device Types
- Function updates
- Continuous improvement efforts
- Above diagram shows what is in progress
- Managed in the Matter Working Group within the Connectivity Standards Alliance

Topics driven by member companies

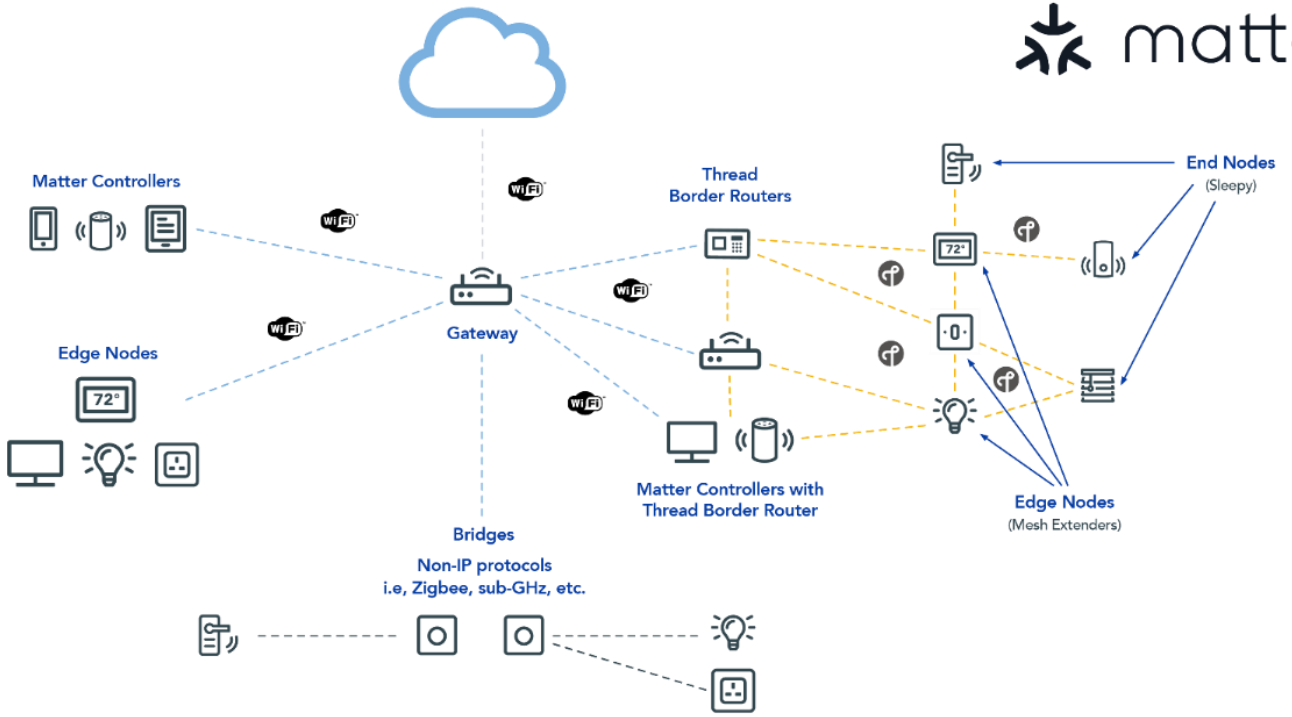
MATTER NETWORKING PROTOCOLS

Matter is an IP-based application layer protocol

- Today Matter transport options are

Ethernet Wi-Fi Thread

- More IPv6 protocols can be added over time
- Bluetooth Low Energy is used for device commissioning



MATTER NETWORK TOPOLOGY OVERVIEW

End Nodes (Thread Sleepy) – Thread only, typically battery powered devices that connect to a Thread Mesh Extender node or Border Router

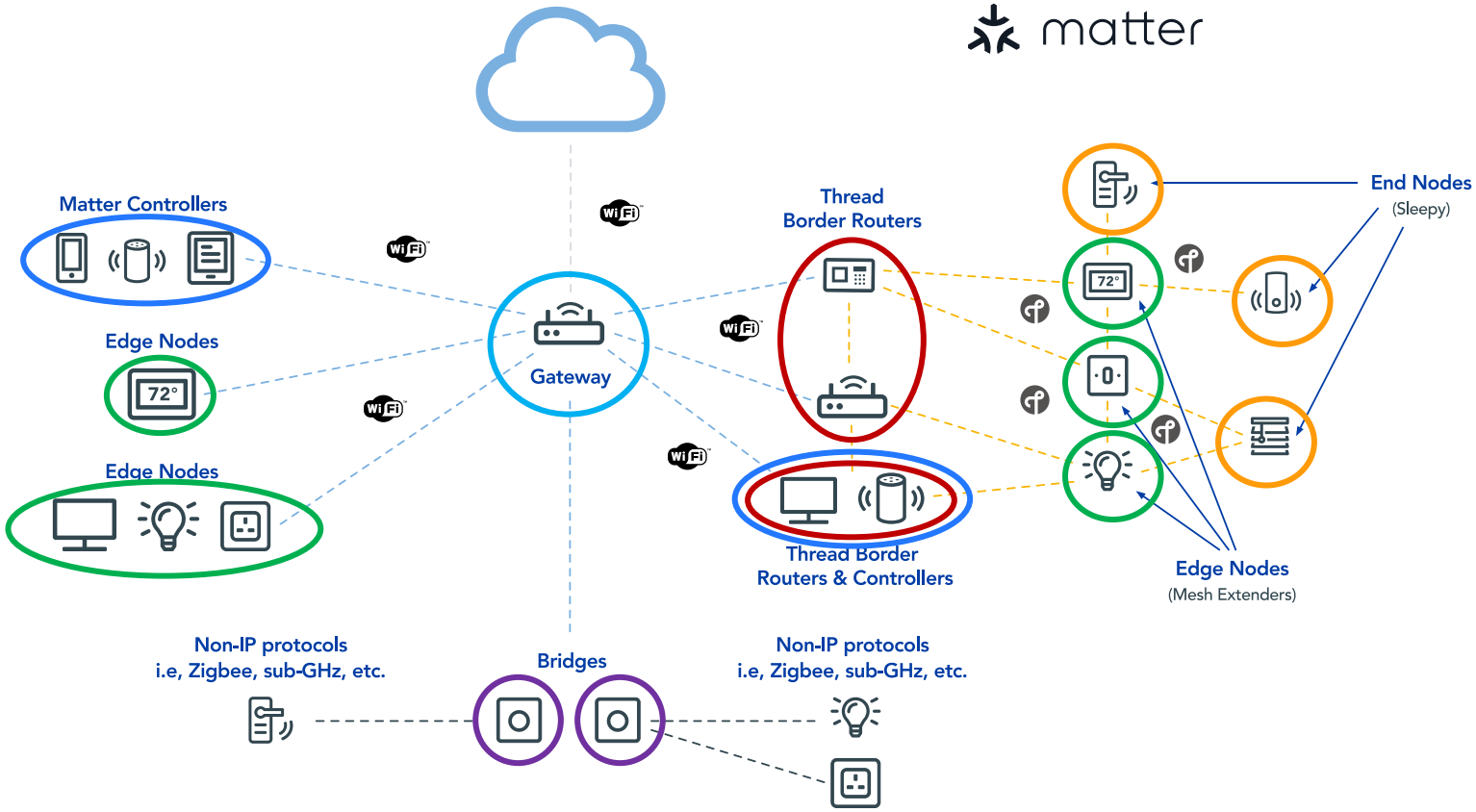
Edge Nodes (Thread Mesh Extenders, or Wi-Fi) – Typically powered devices connected to Wi-Fi, or routing Thread Mesh Extenders

Thread Border Router – Connects the Wi-Fi and Thread networks, can be integrated in Matter application product devices*

Gateway/Hub – Connects the Matter network to the cloud

Bridge – Connects the Matter network to a legacy Smart Home system

Controller – Used to provision Matter devices to the system

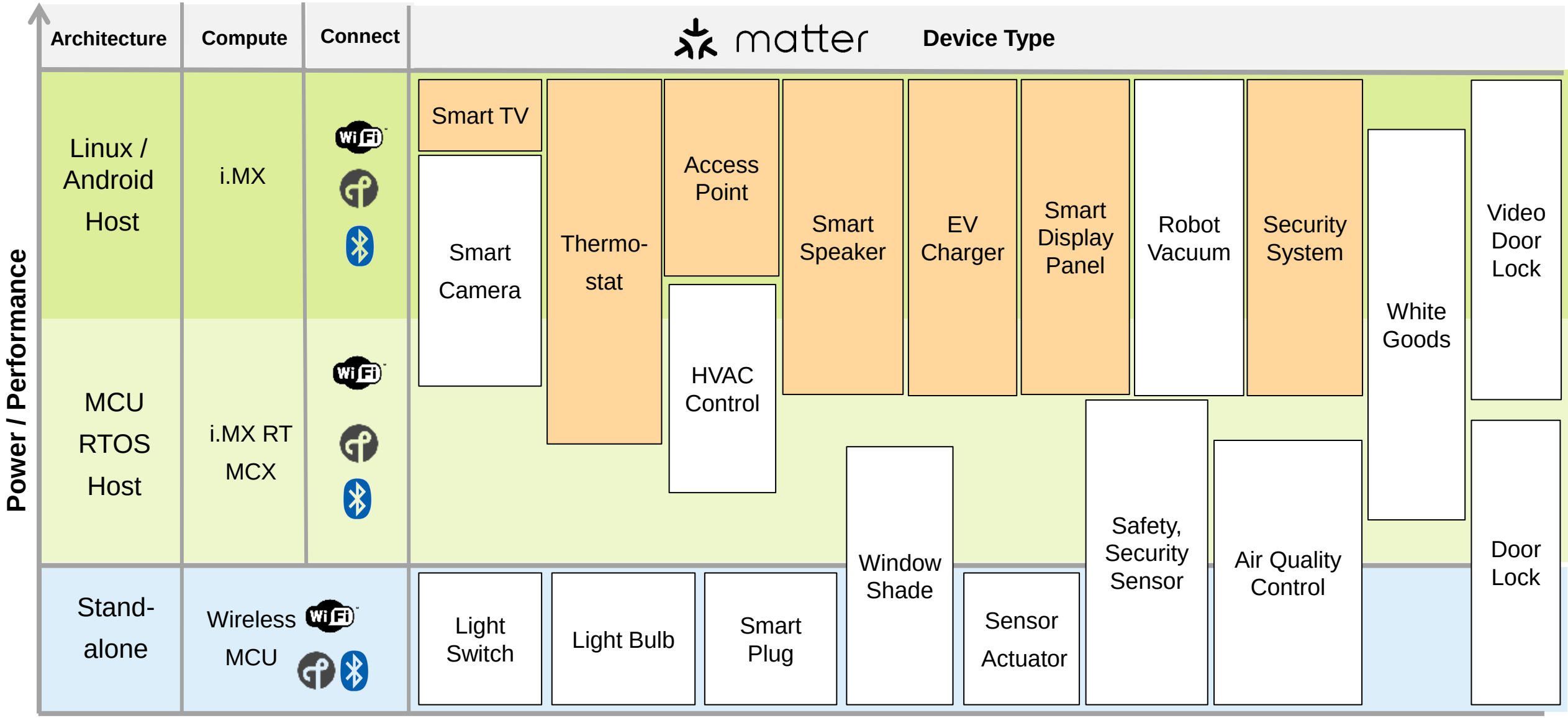


*Thread allows multiple Border Routers in a network to improve range and reliability

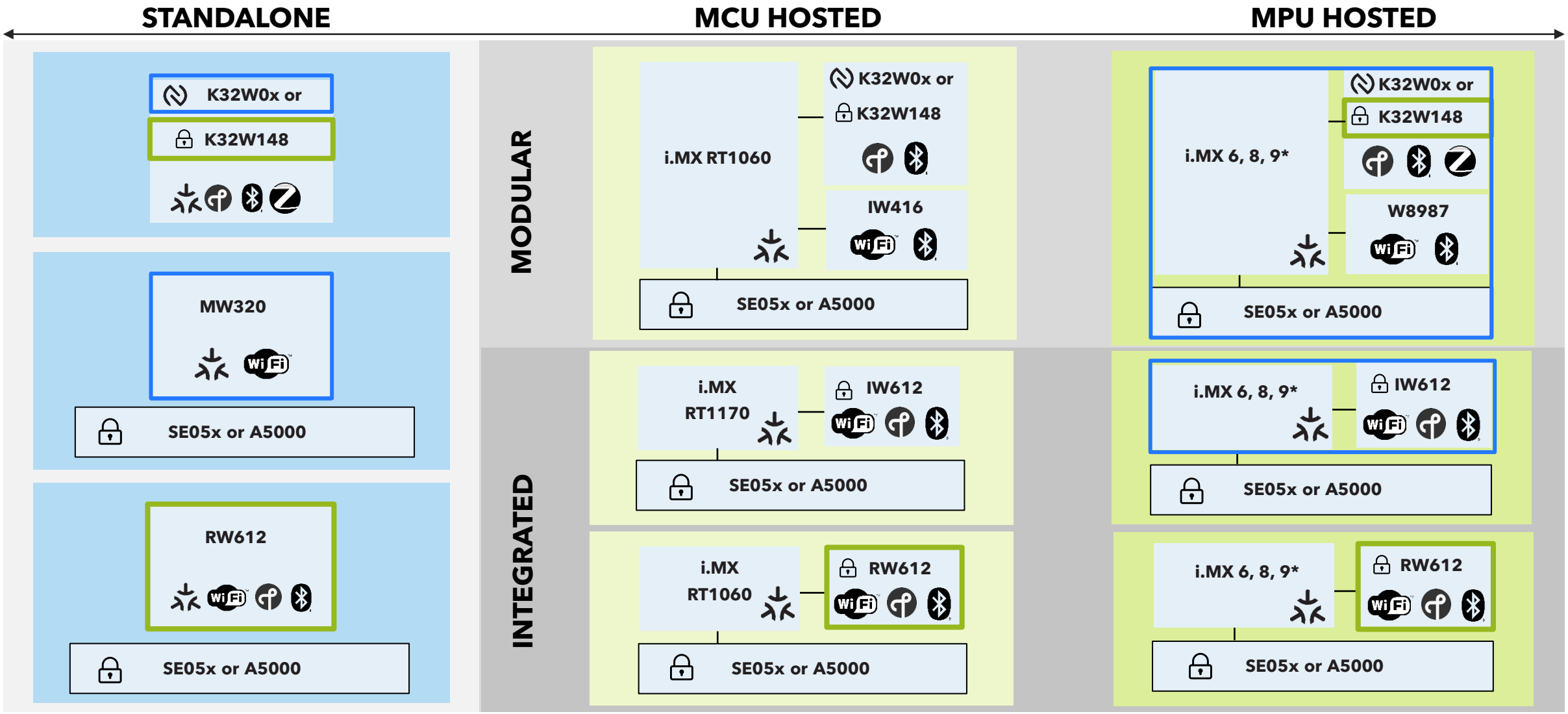
MATTER EXAMPLE ARCHITECTURES

DIFFERENT SOLUTIONS FOR YOUR SMART HOME USE CASE

Matter Controller | Matter Device



MOST COMPLETE PORTFOLIO OF PLATFORMS AND GROWING

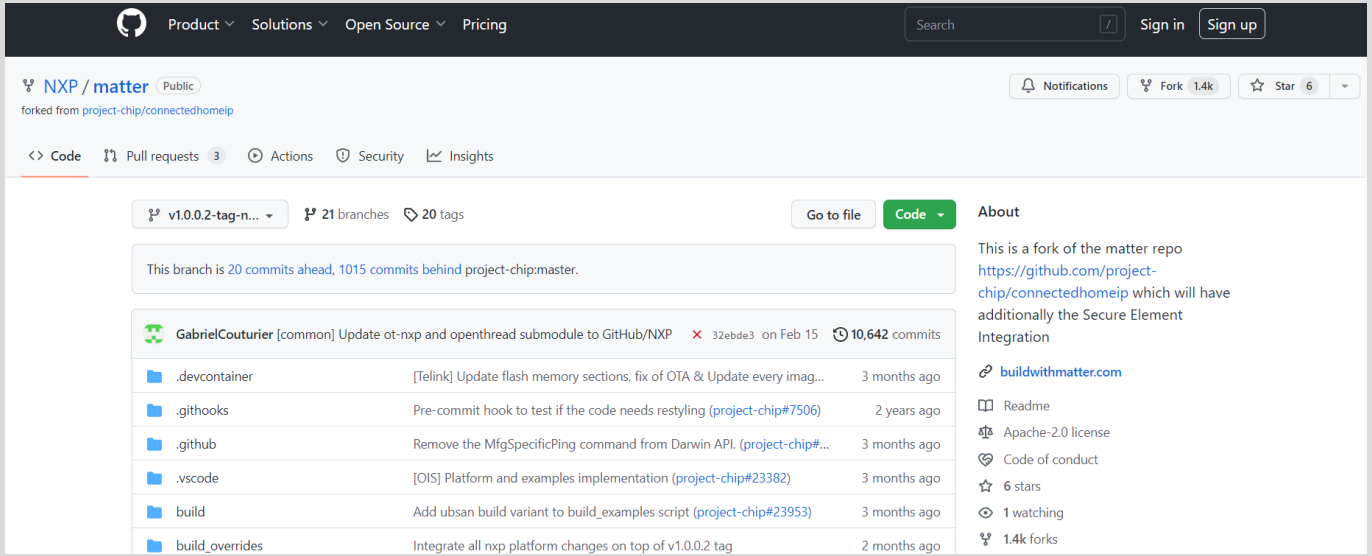


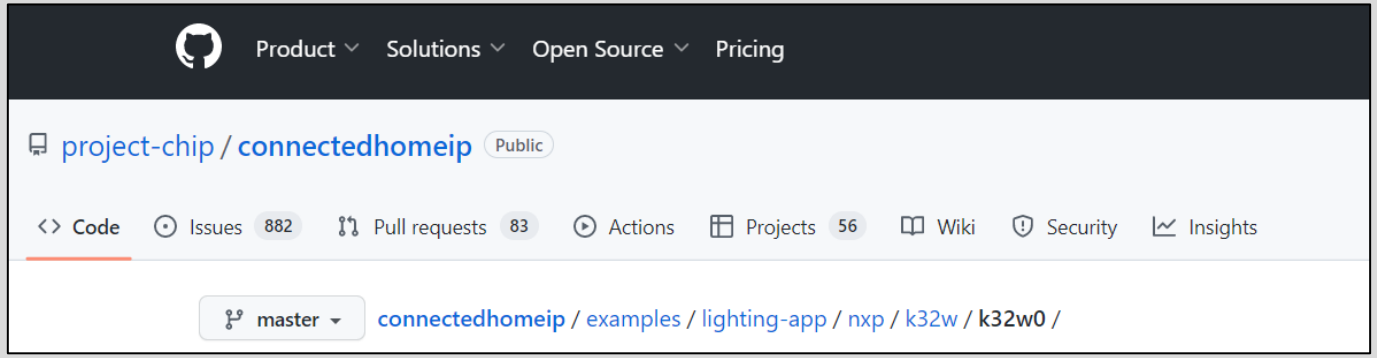
*NOTE: Matter requires end product certification. NXP Linux platform certified on i.MX 8M Mini, same Yocto recipe can be used for other i.MX products, e.g., i.MX 93

NXP MATTER SOFTWARE FOR STANDALONE OR MCU HOSTED PLATFORMS

- Two paths to access software
  - Matter upstream Github
  - NXP fork of upstream on our NXP Github account
  - Recommendation: Use NXP github as that is what NXP tests and validates

- Steps to download and use the code
  - Clone the repository linked above
  - Navigate to *examples* folder, and select the target example project
    - e.g.: K32W0 Lighting app cluster
  - Follow the instructions to setup the environment and build the project from the *.readme* in the example project

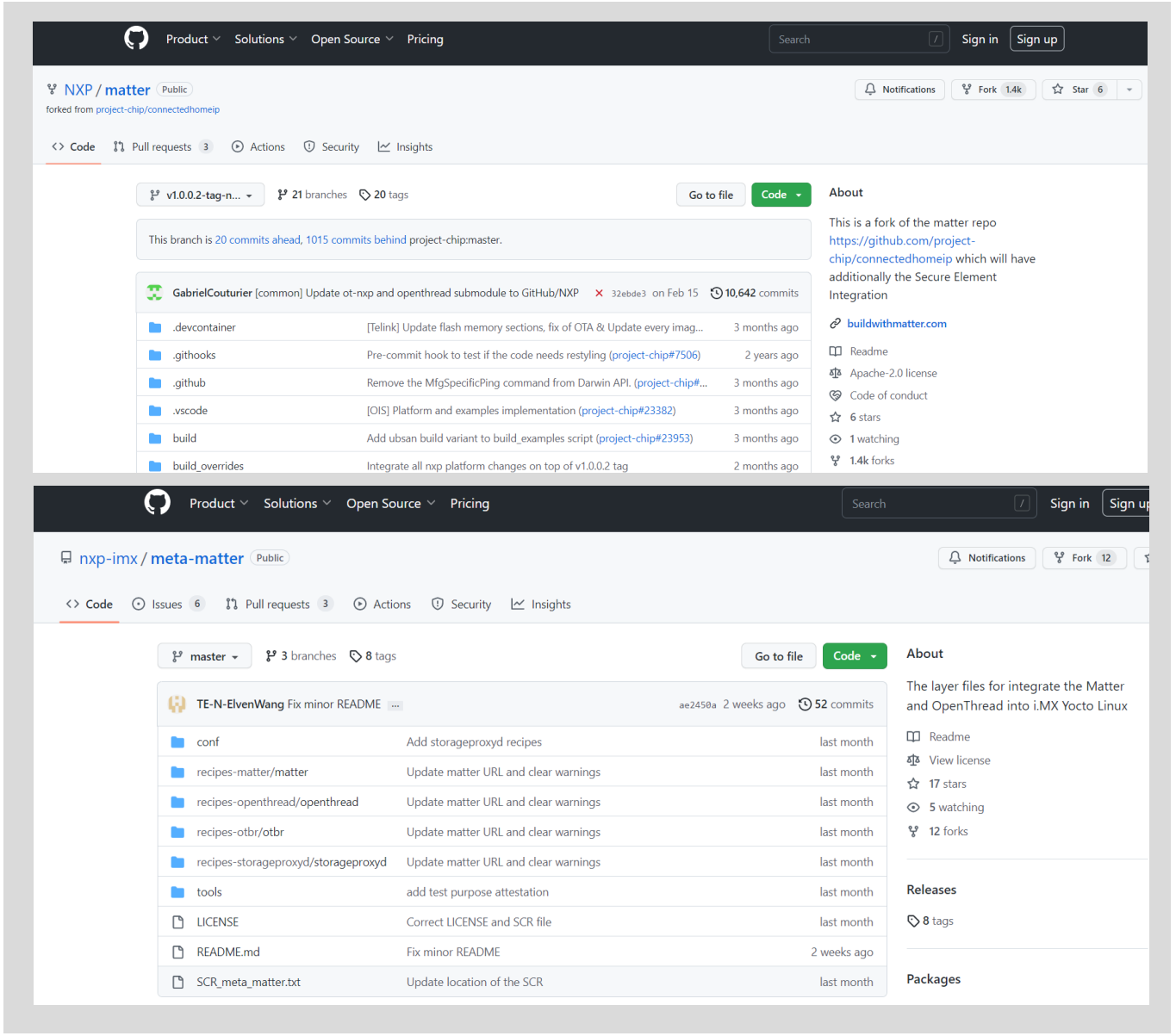




NXP MATTER SOFTWARE FOR LINUX HOSTED PLATFORM

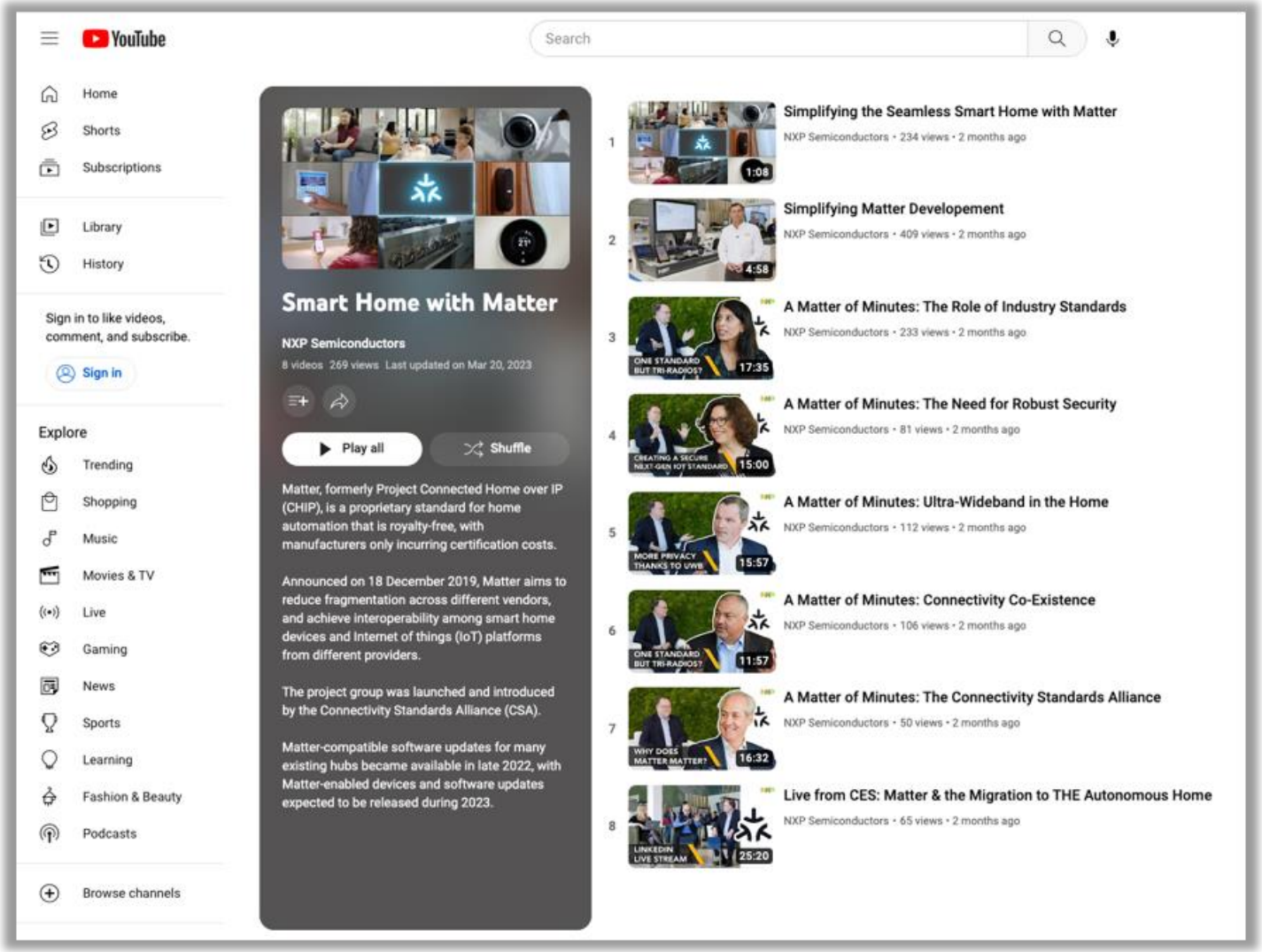
- Two paths to access software
  - Upstream in the Matter Github repo
  - Steps to download and use the code
    - Clone the repository linked above
    - Navigate to *examples* folder, and select the target example project
      - e.g.: K32W0 Lighting app cluster
    - Follow the instructions to setup the environment and build the project from the *.readme* in the example project

- Application SW pack on NXP github account
  - To build the software example, follow the instructions from the *readme* file in the github repo

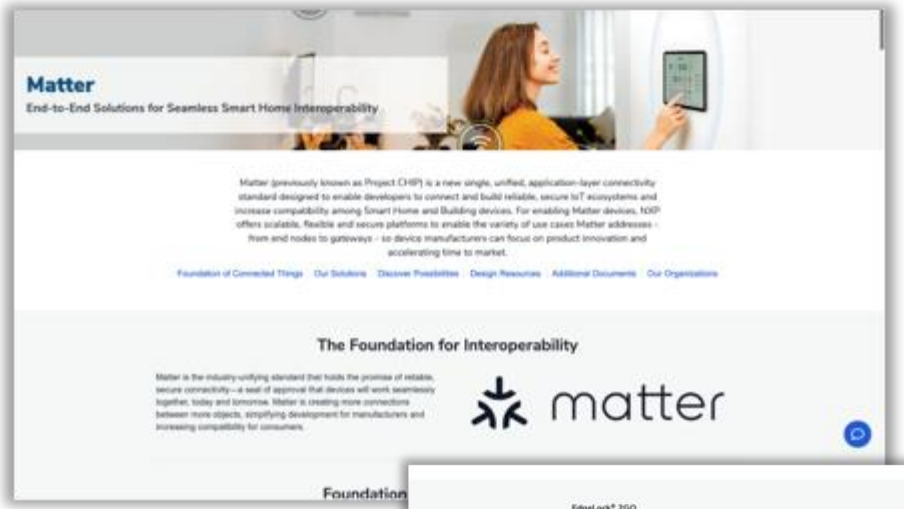


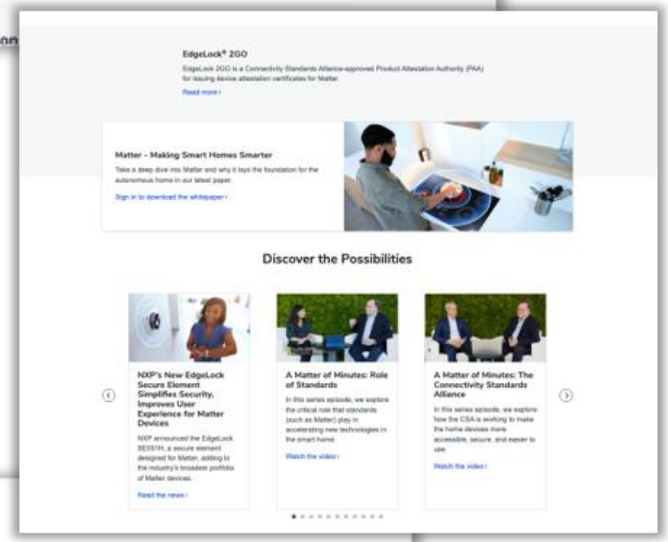
NXP MATTER RESOURCES

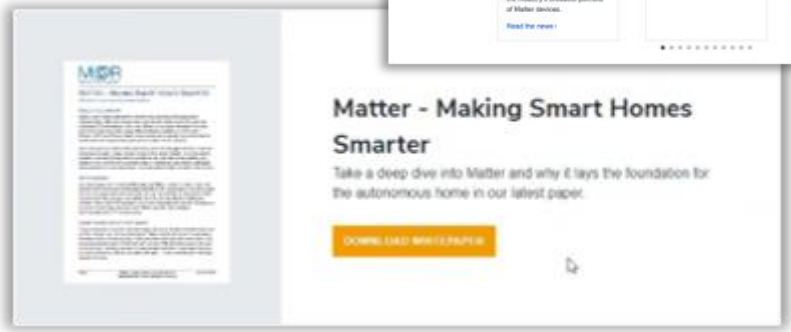
[NXP YouTube: Smart Home Playlist]



[nxp.com/matter]

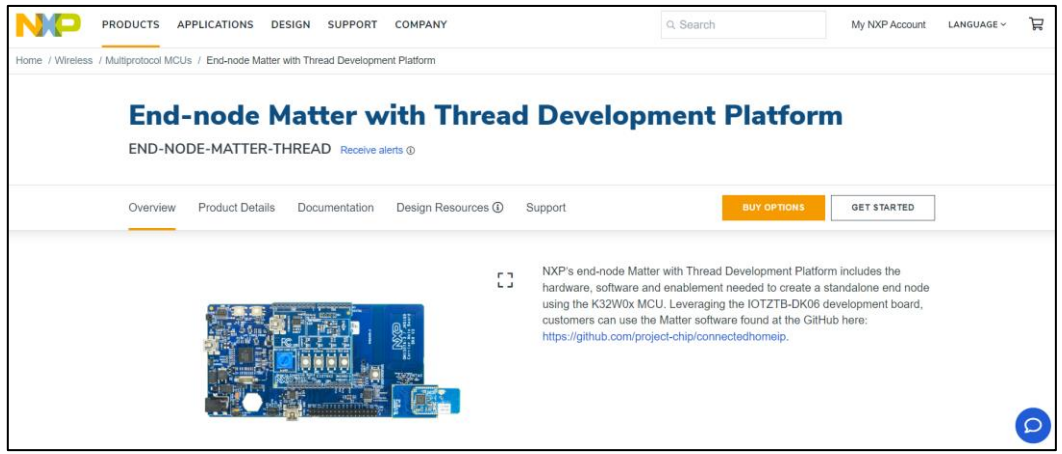




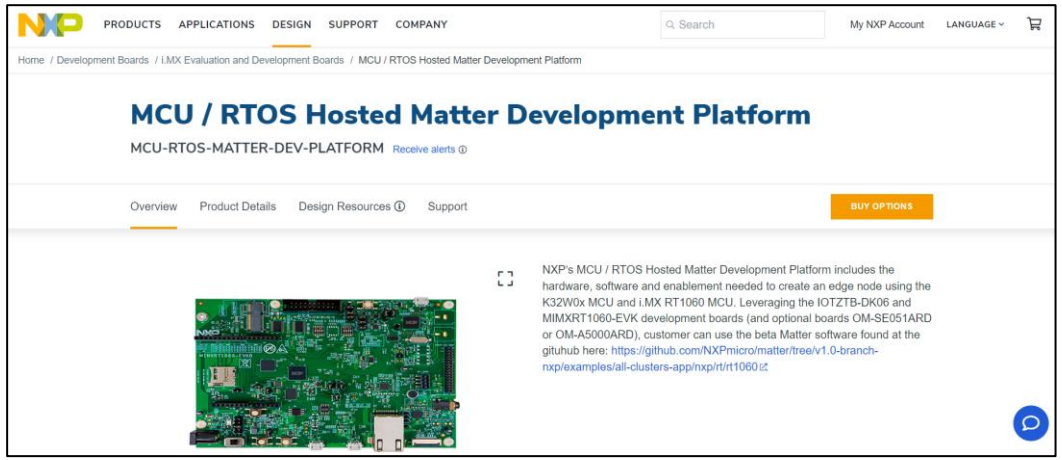


MATTER DEVELOPMENT PLATFORMS ON NXP.COM

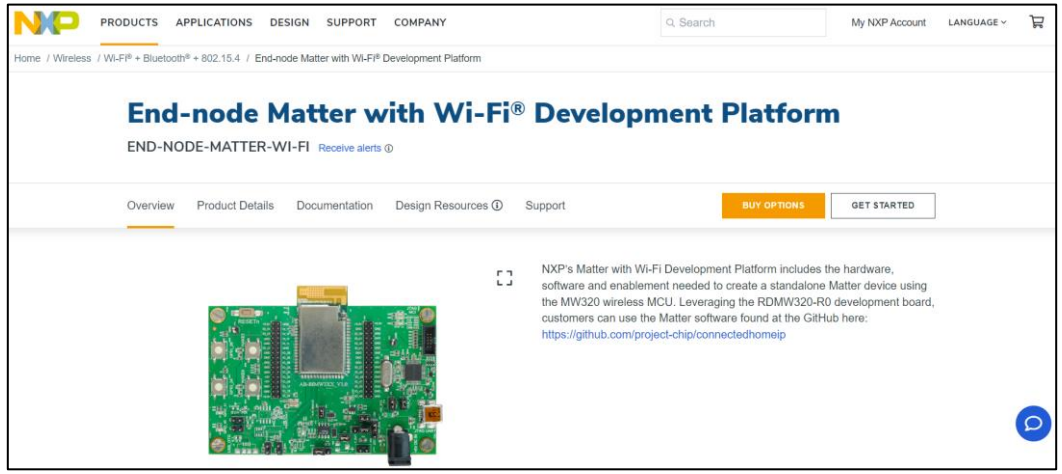
Thread Hostless



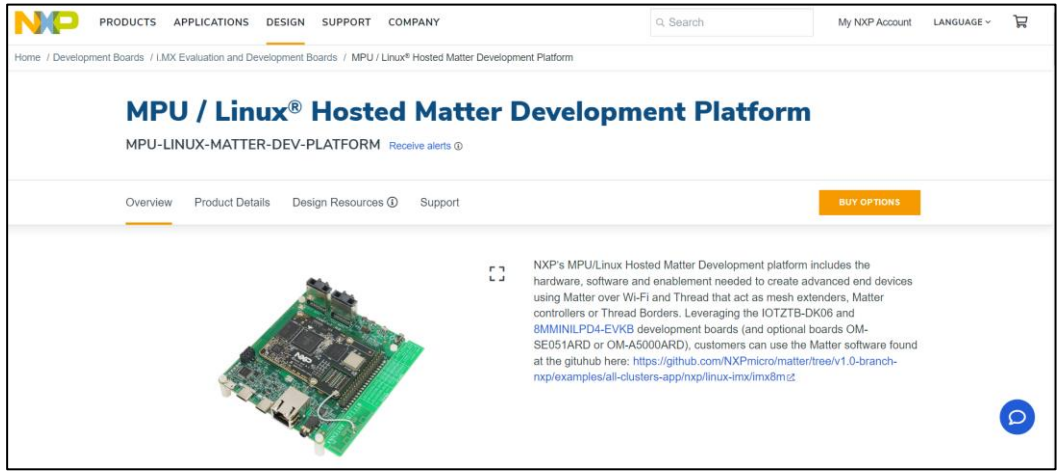
RTOS Hosted



Wi-Fi Hostless



Linux Hosted



NXP MULTIPLE SUPPORT OPTIONS

Increasing level of support

- NXP Professional Services (Project managed per SoW)
- NXP Strategic Deployment Team
- NXP Professional Support (support hours packages)
- NXP Partnership program and Ecosystem
- Factory System Engineering (applications) teams
- Local FAE/DFAE support
- NXP online Communities
- Online information; Reference designs, Application Notes, etc.

Market environment

AT A GLANCE

Plenary – March I 2023

European Parliament

Energy Performance of Buildings Directive

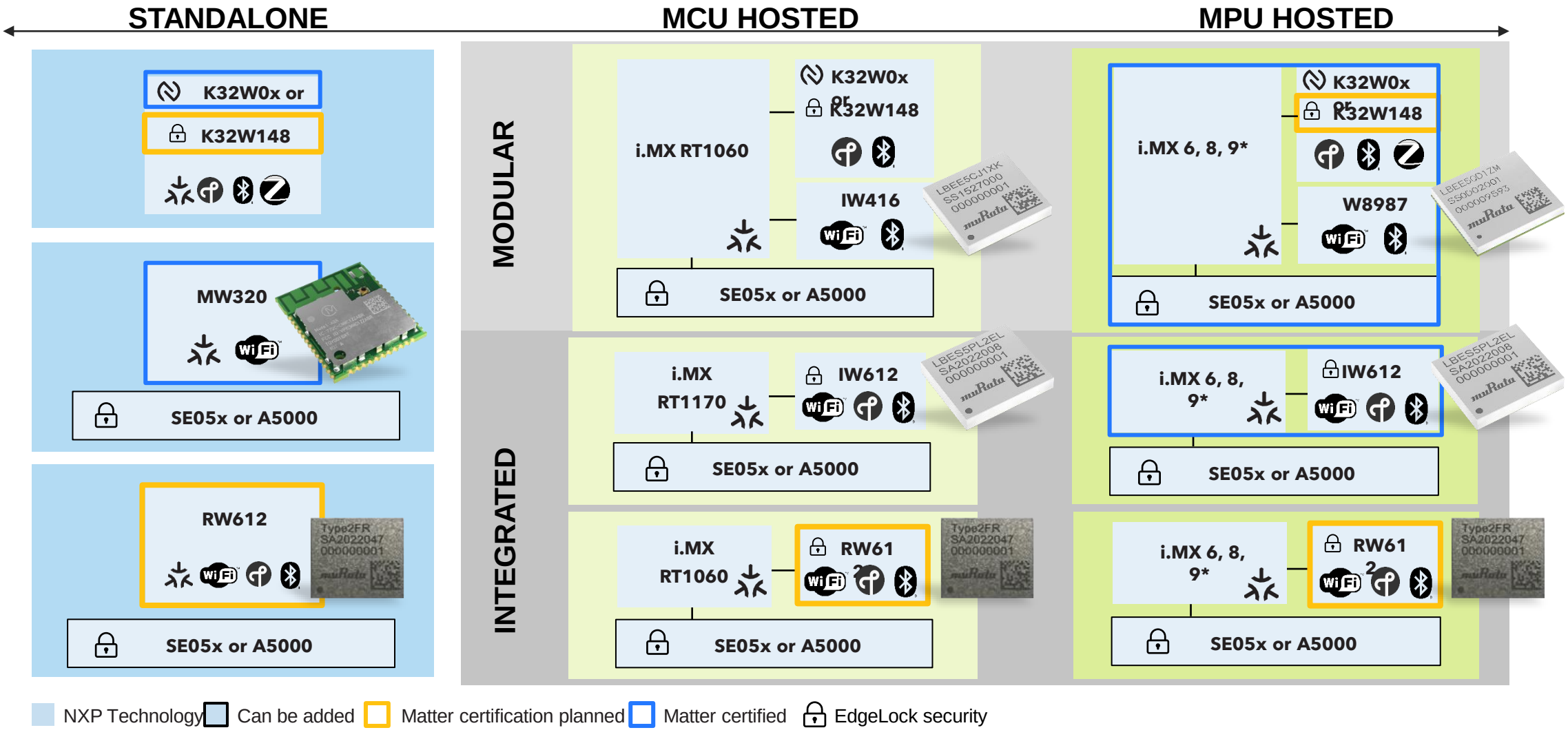
The Parliament is due to vote in plenary in March on a report from the Committee on Industry, Research and Energy (ITRE) on the proposal to revise the Energy Performance of Buildings Directive, part of the 'fit for 55' package. Once adopted, this will set Parliament's position for trilogue negotiations with the Council.

- New Directive can be achieved by renewable energy solutions, materials reuse and recycling, insulation… **Smart Home and Smart Energy Management** are also solutions mentioned on this directive.

Energy management

- Dynamic energy prices.
- Inclusion of renewable energies sources at home.
- EV charging.

Most complete portfolio of platforms and growing



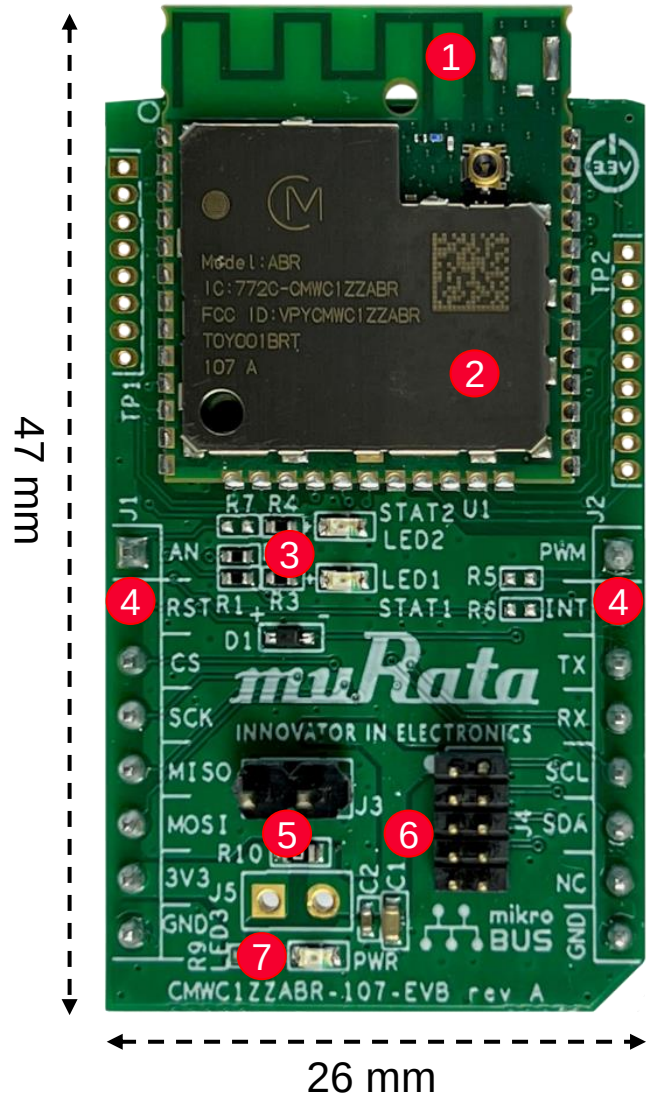
*NOTE: Matter requires end product certification. NXP Linux platform certified on i.MX 8M Mini, same Yocto recipe can be used for other i.MX products, e.g., i.MX 93

Type ABR: Wi-Fi Hostless/Hosted Module

NXP Chipset	88MW320
Murata Module	ABR
Sample	Available
MP Date	Now

- 802.11 b/g/n Wi-Fi
- ARM Cortex-M4 200MHz
- 22.0 x 19.0 x 2.4 (typ) mm
- Integrated PCB antenna & U.FL connector
- SPI Flash on module (2MB)
- UART Wi-Fi Host Interface & GPIO Control
- Shielded, FCC/IC Certified
- CE Conducted Test Reports Available
- https://www.murata.com/products/connectivitymodule/wi-fi-bluetooth/overview/lineup/typeabr

Type ABR: Murata's ABR mikroBUS EVB



1) Built-in PCB trace antenna (pre-certified; on module).

2) Murata Type ABR Module
   NXP MW320 - 11b/g/n + MCU
   Interfaces = WLAN UART
   Optional = WLAN SPI

3) LED indicators for "WLAN link" and "module ready".

4) mikroBUS headers.

5) Boot mode header.

6) ARM 10-pin interface SWD mode

7) Power LED indicator.

Part Number: CMWC1ZZABR-107-EVB

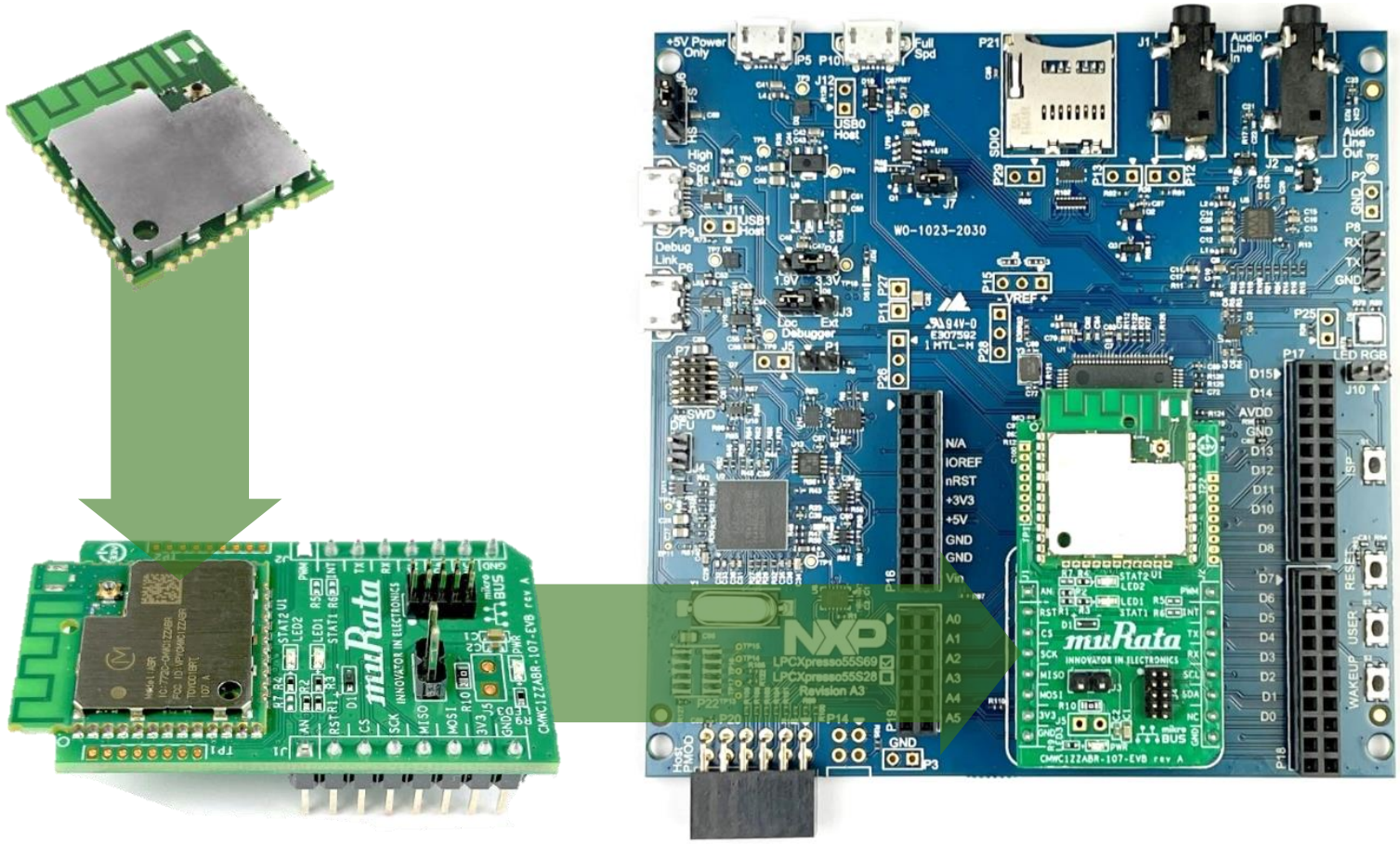
https://www.murata.com/products/connectivitymodule/wi-fi-bluetooth/overview/lineup/typeabr#eval-tool

Type ABR mikroBUS™ Evaluation Board

Type ABR mikroBUS™ EVB enabling Wi-Fi on various MCUXpresso platforms:

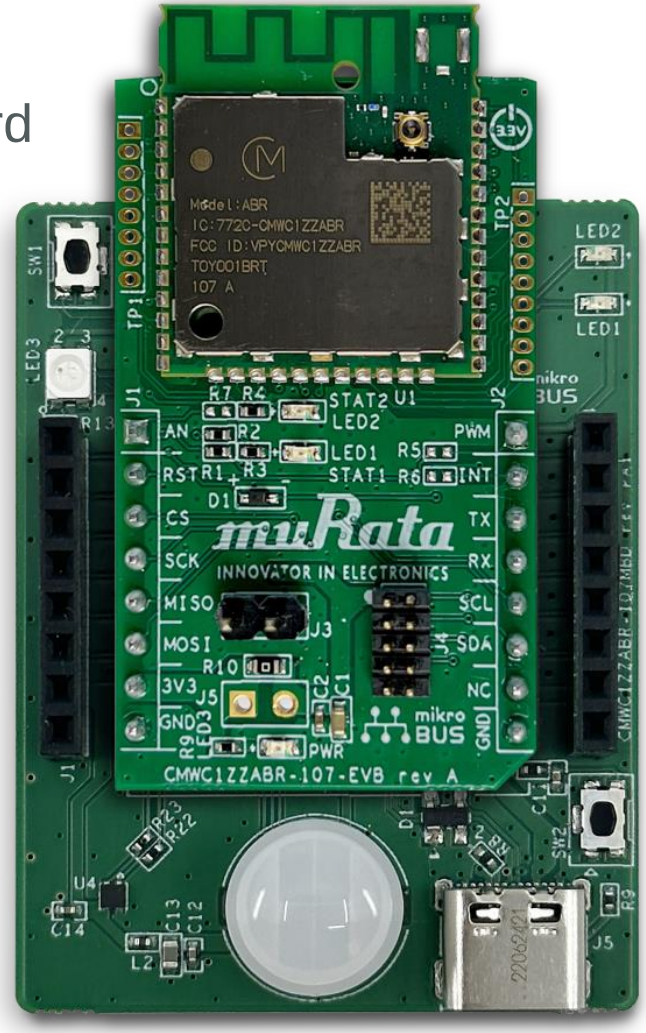
Type ABR integrated on:

- LPCXpresso55S16
- LPCXpresso55S28
- LPCXpresso55S69
- LPCXpresso54628
- LPCXpresso54S018
- LPCXpresso54S018M
- FRDM-K32L2A4S
- EVK-MIMXRT1010



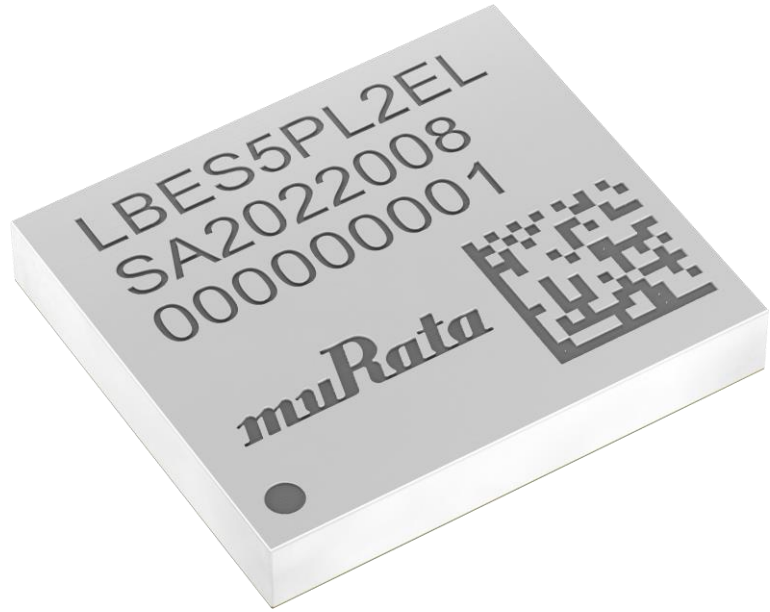
Type ABR: Stand-alone configuration for Matter

- Type ABR Motherboard: Part# CMWC1ZZABR-107MBD
- Existing CMWC1ZZABR-107-EVB plugs directly into motherboard
- USB-C interface to PC Host (also provides power)
- Reset and user-defined push-buttons
- Side headers provide easy access to mikroBUS signals
- Murata PIR I2C (motion) sensor
- Temperature I2C sensor
- Red, Blue, Green LED indicators
- Will be sold through Distribution



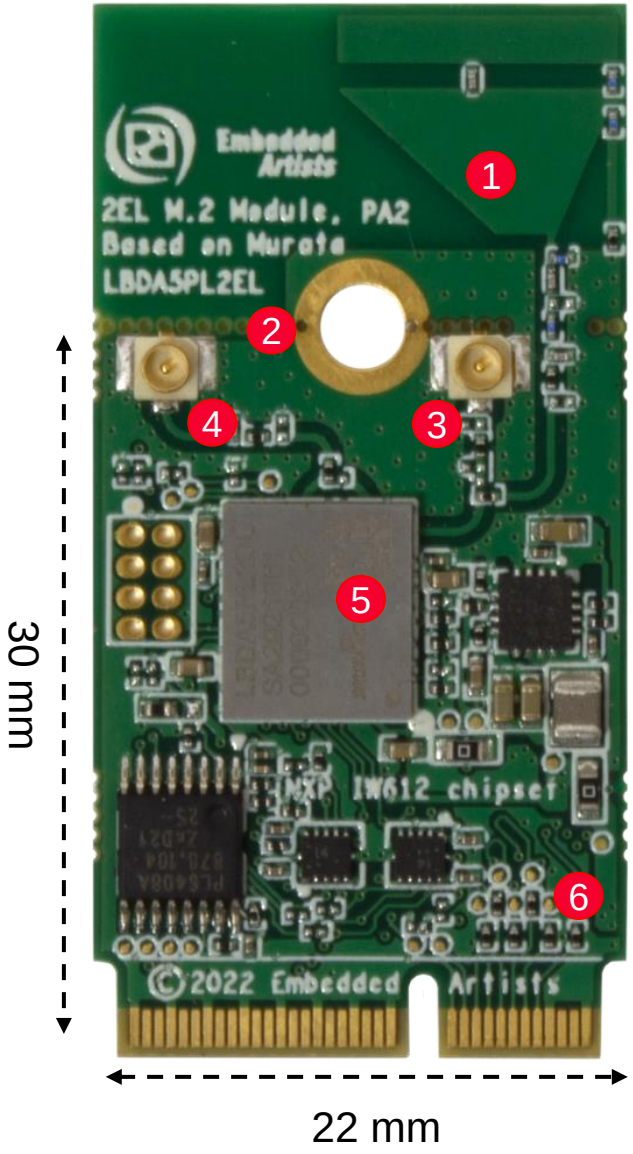
Type 2EL: Wi-Fi/Bluetooth/Thread Hosted Module

NXP Chipset	IW612
Murata Module	2EL
Sample	Available
MP Date	Ramping Up



- 802.11 a/b/g/n/ac/ax + Bluetooth 5.3 + Thread (802.15.4)
- 7.7 x 8.8 x 1.3 (typ) mm
- SDIO 3.0 Wi-Fi Host Interface
- UART Bluetooth Host Interface; PCM for Bluetooth audio
- SPI for Thread (802.15.4) Host Interface
- Shielded, FCC/IC/TELEC “Reference” Certified (underway)
- CE Conducted Test Report (will be available)
- Single or dual (independent Bluetooth/Thread) antenna configurations available
- U.FL-connected PCB antenna or Murata customized PCB trace antenna options
- https://www.murata.com/products/connectivitymodule/wi-fi-bluetooth/overview/lineup/type2el

Type 2EL: Embedded Artists' M.2 Module



1) Reference Certified PCB Trace (shared WLAN/BT/Thread) Antenna (2.4/5 GHz)

2) MAX 30mm length snap-off option (U.FL connector used)

3) U.FL Connector for external (shared WLAN/BT/Thread) antenna

4) Optional dedicated Bluetooth/Thread U.FL connector.

5) Murata Type 2EL Module
   NXP IW612 - 11a/b/g/n/ac/ax + BT 5.3 + 802.15.4
   Interfaces = WLAN SDIO 3.0; BT UART/PCM; 802.15.4 SPI

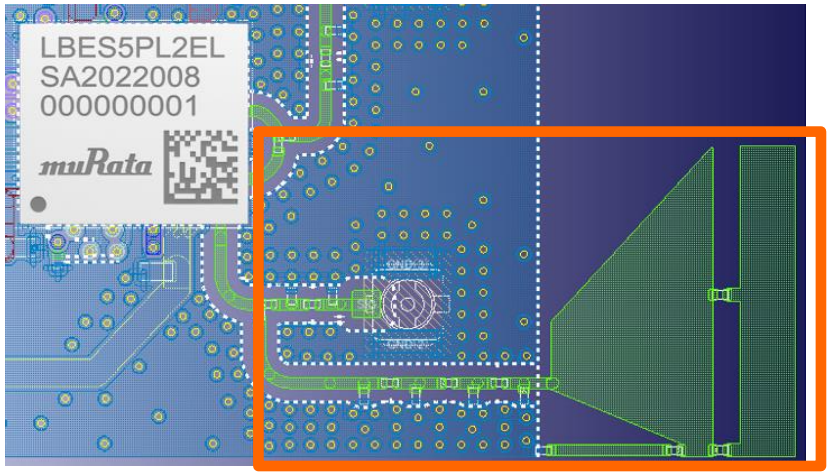
6) Comprehensive Test Points

Part Number: EAR00409

Embedded *Artists*

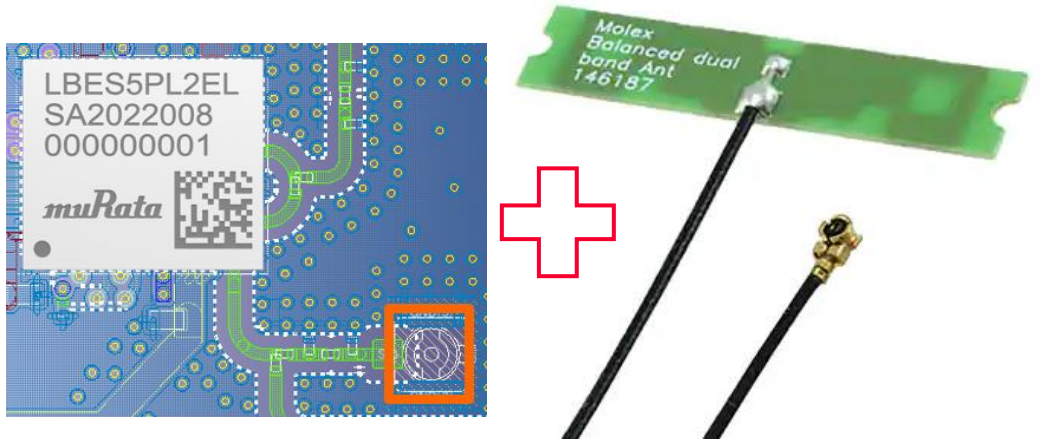
https://www.embeddedartists.com/products/2el-m-2-module/

Type 2EL: Regulatory Certification Options



Reference Certified Antenna Solution

- Reference Certification leverages cost-optimized PCB trace antenna
- Omnidirectional radiation pattern
- Peak Gain (dBi): 2.6 @ 2.4 GHz, 3.6 @ 5 GHz
- Customer copies antenna design from provided layout file
- Customer copies RF trace to PCB trace antenna; adhering to additional guidelines on:
  - ❖ Trace width inaccuracy within +/- 0.25 mm
  - ❖ PCB thickness within 0.6-1.6 mm range
  - ❖ Stack height between GND layer and RF trace of 235 um; keeping inaccuracy within +/- 0.5 um
  - ❖ Passive component location matching Murata design

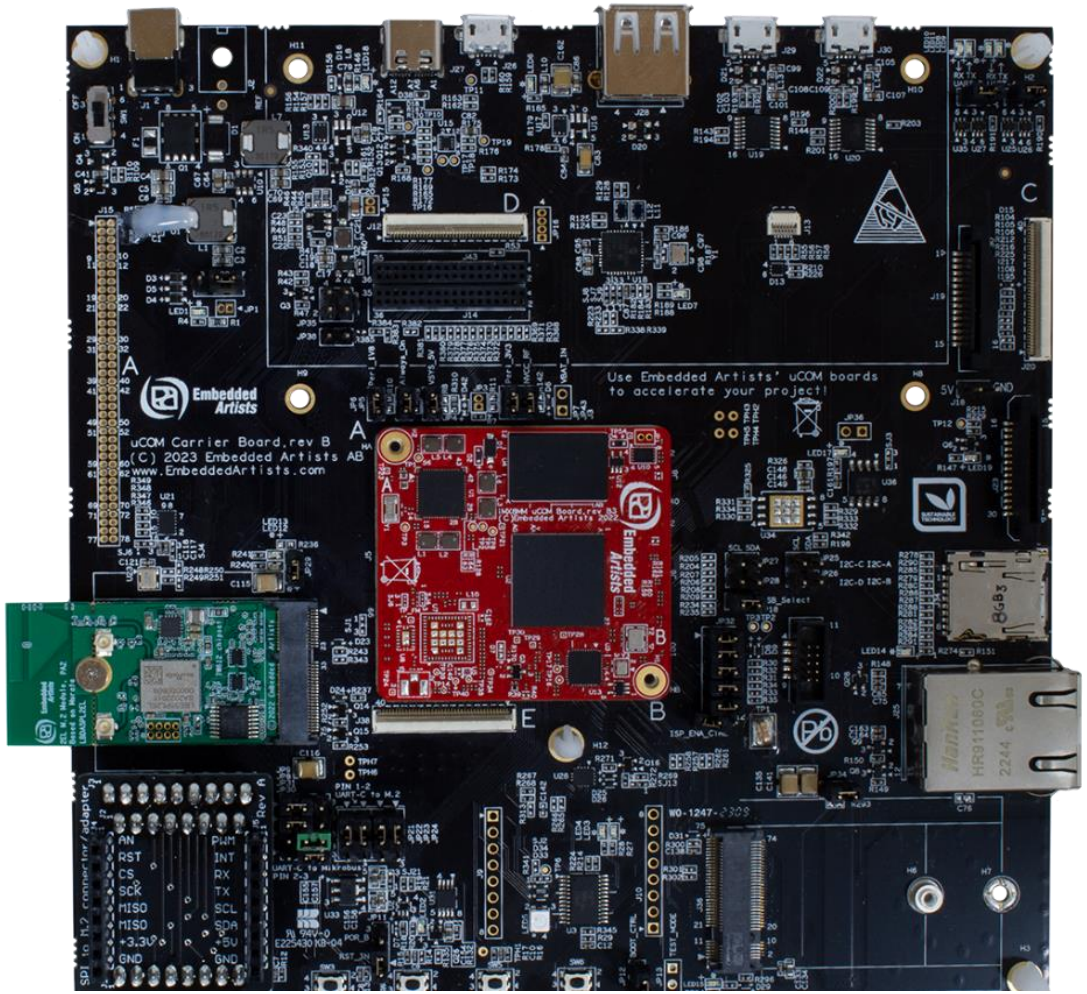


Certified External Antenna Solution

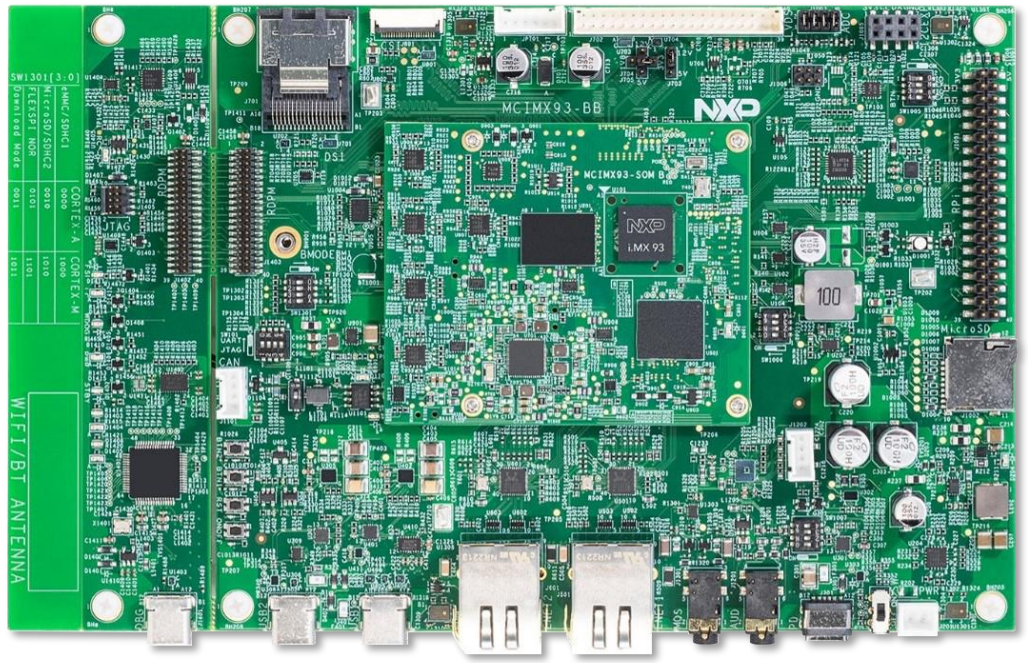
Series	Vendor	Form factor	Type	2.4GHz Gain	5GHz Gain	Cable options
146153	Molex	U.FL/flexible	Di-pole	3.2dBi	4.25dBi	050 (50mm) or longer cable
WT32D1-KX	Unictron	U.FL/PCB	Di-pole	3dBi	4dBi	150mm (H2B1WD1A 3B0200)
219611	Molex	U.FL/flexible	Di-pole	2.67dBi	3.67dBi	050 (50mm) or longer cable

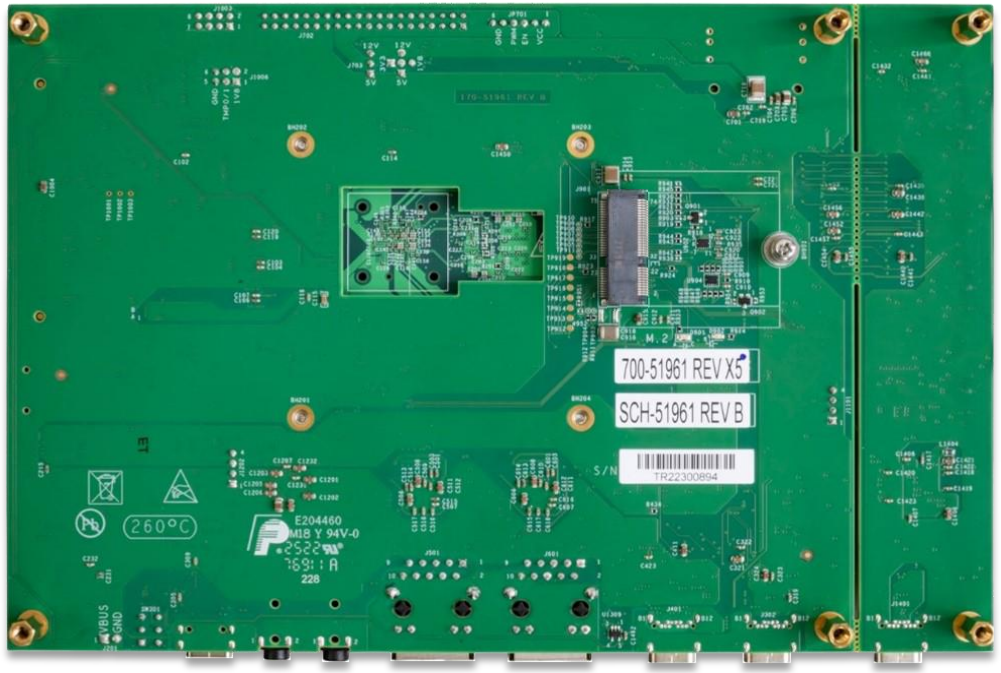
Embedded Artists i.MX 8M Mini Developer's Kit v3 + Murata Type 2EL

- NXP provides Matter support on i.MX 8M Mini.
- Murata Type 2EL (IW612) is integrated on Embedded Artists 2EL M.2 that connects directly on the M.2 slot of the Developer's Kit.
- IEEE 802.15.4 Thread transport is provided via SPI special adapter below the M.2 card.
- Bluetooth UART transport also provided via the M.2 interface.
- Embedded Artists Developer's Kit v3, i.MX 8M Mini uCOM and 2EL M.2 are available directly from Embedded Artists website and distribution.
- Flexibility to replace uCOM cards to other Application Processor as well the M.2 card to another module.



i.MX93 with Murata Type 2EL





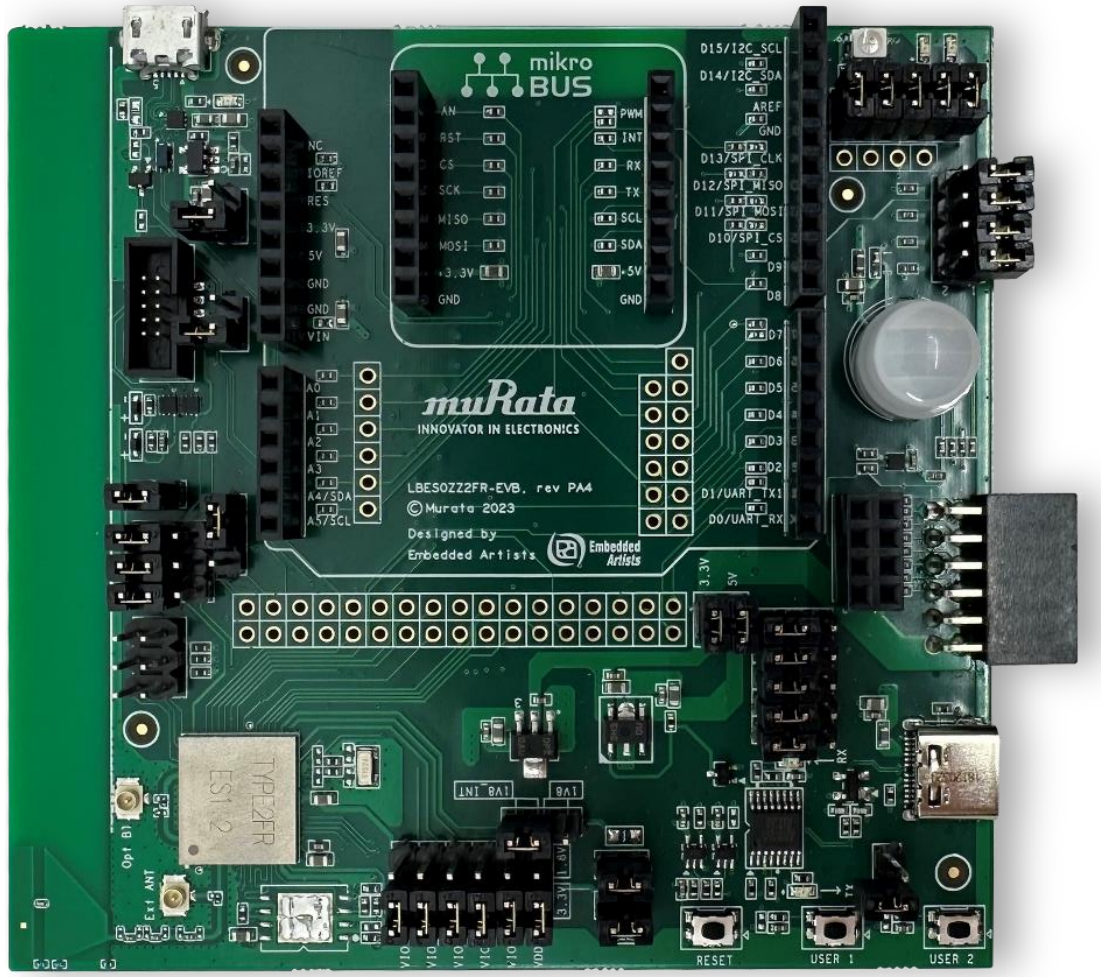
Type 2FR/2FP: MCU + Wi-Fi/BLE/(Thread) Hostless Module

NXP Chipset	RW612/RW610
Murata Module	2FR/2FP
Sample	Contact Murata
MP Date	Q4/2023

- 260 MHz Arm® Cortex® -M33 MCU + 802.11 a/b/g/n/ac/ax + BLE 5.3 + Thread (2FR only)
- 12.0 x 11.0 x 1.5 (Max.)
- Ethernet 802.3 (wired), SDIO 3.0 (WLAN), USB-OTG, I2C, I2S, SPI, USART
- Shielded, FCC/IC/TELEC “Reference” Certified (TBD)
- CE Conducted Test Report (TBD)
- Single or dual (independent BLE/(Thread – 2FR only)) antenna configurations available
- U.FL-connected PCB antenna or Murata customized PCB trace antenna options

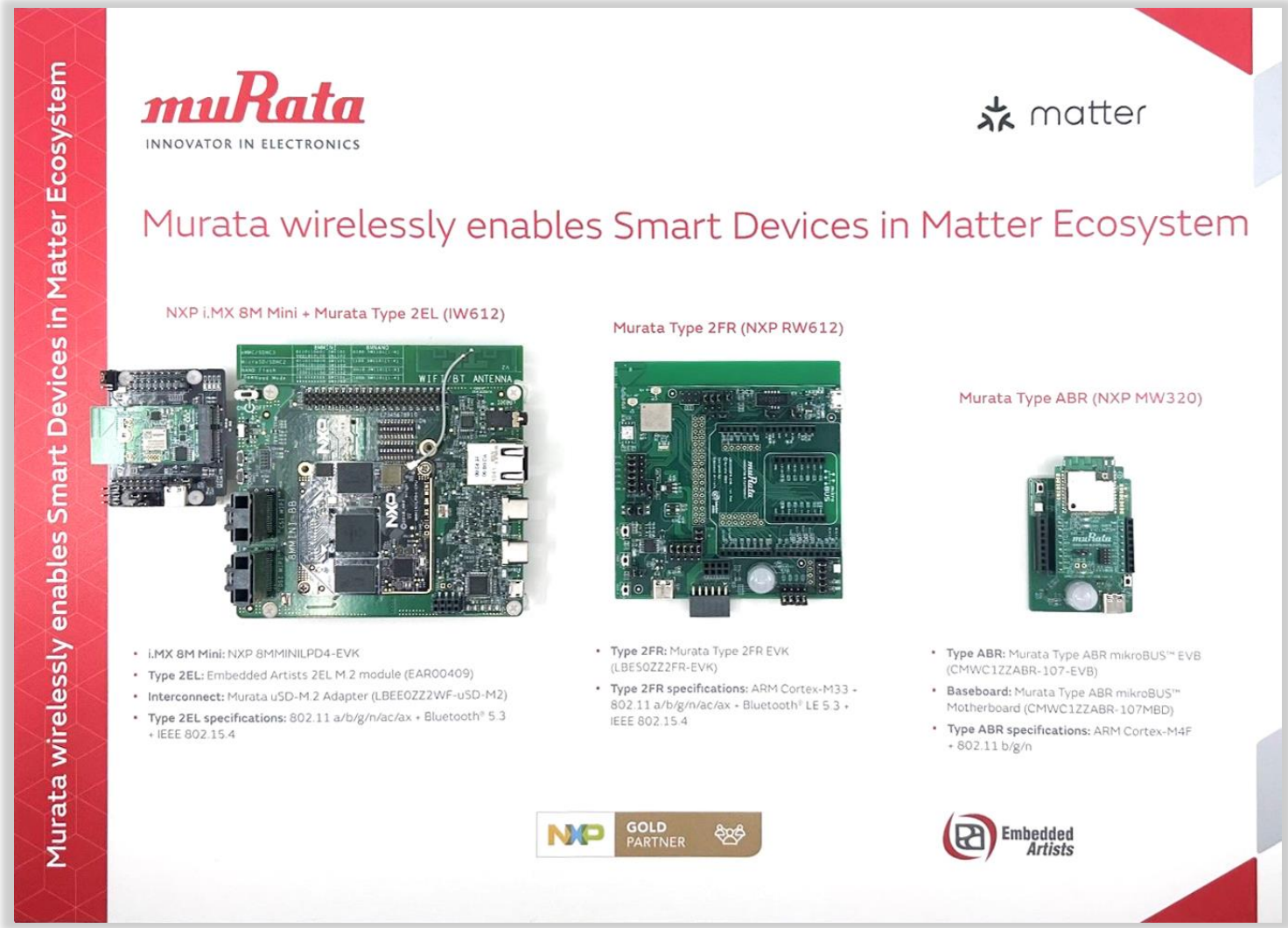
Murata Type 2FR EVK

- Reset button; two user-defined buttons
- 5 configurable LEDs
- Onboard PCB antenna – EVK will be certified
- PIR motion and temperature I2C sensors
- mikro-BUS, Arduino, PMOD, I2C, expansion interfaces
- USB debug/console, USB OTG
- ARM 10-pin interface: SWD or JTAG
- Boot control configurable via jumpers
- QSPI flash, 32 KHz slow clock
- Current measurement jumpers (resistor option)
- Ethernet port
- Will be sold through Distribution



Murata's Modules Enabling Matter (summary)

- NXP i.MX 8M Mini EVK with Murata Type 2EL (enabled by Embedded Artists M.2 EVB and Murata uSD-M.2 Adapter) provides Matter edge router capability.
- Murata Type 2FR EVK is being re-spun to add ethernet interface. This provides stand-alone solution for Matter nodes all the way up to edge router configuration. Type 2FR (RW612) supports Wi-Fi/BLE/Thread and ethernet.
- Type ABR EVB coupled to motherboard which provides stand-alone configuration. Matter stack integrated into NXP MW320 chipset firmware.
- Type 2FR and ABR solutions integrate PIR and temperature I2C sensors.

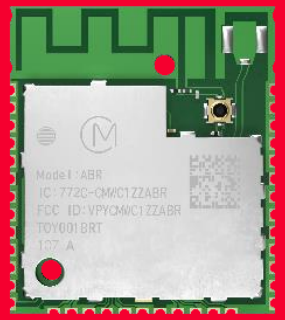


Question & Answer

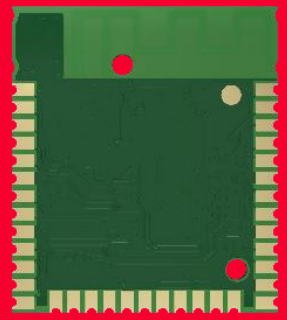
Type ABR: NXP 88MW320 - 11b/g/n + MCU

Part Number	Murata Part#	CMWC1ZZABR-107
Chipset	Wi-Fi + MCU	NXP 88MW320
Features	Wi-Fi	IEEE802.11b/g/n
	Interface	UART (WLAN) GPIO (CTRL)
	Dimensions L x W x H (mm)	22.0 x 19.0 x 2.4 (typ)
	Shielding	Metal case
	Operating Temp. (°C)	-30 to +85
Certification	Regulatory Certification	FCC/IC, CE
Schedule	Sample	Available
	MP	Now

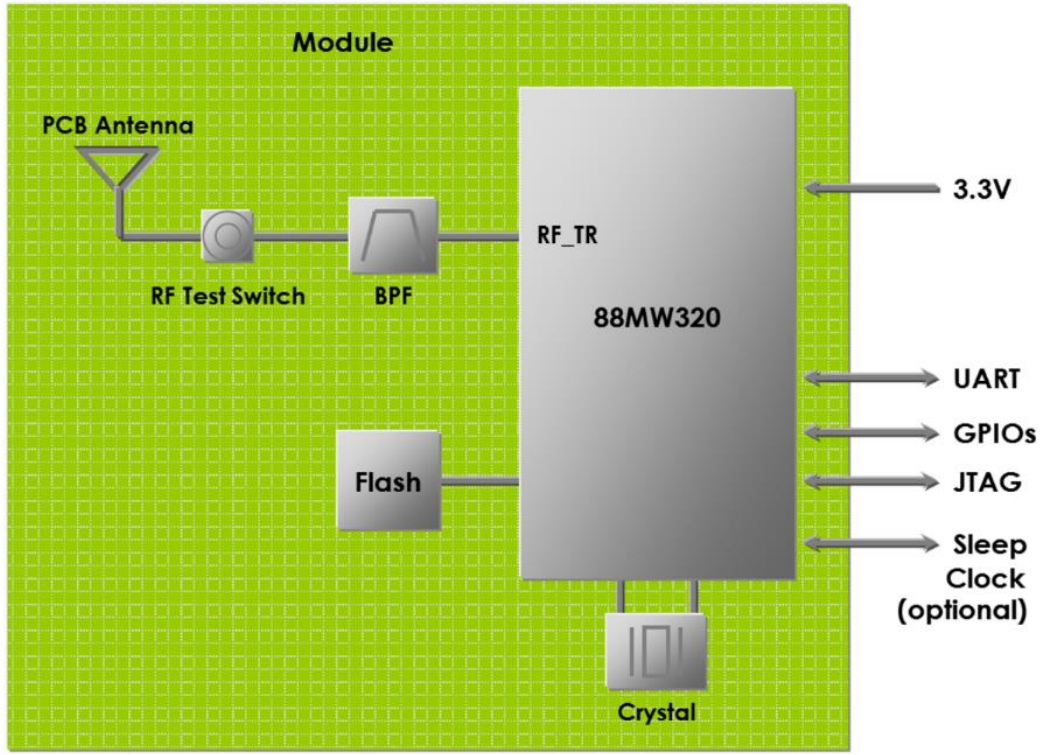
Top View



Bottom View



Block Diagram

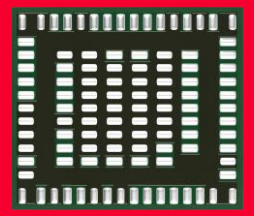


Type 2EL: NXP IW612 - 11a/b/g/n/ac/ax + BT 5.3 + Thread

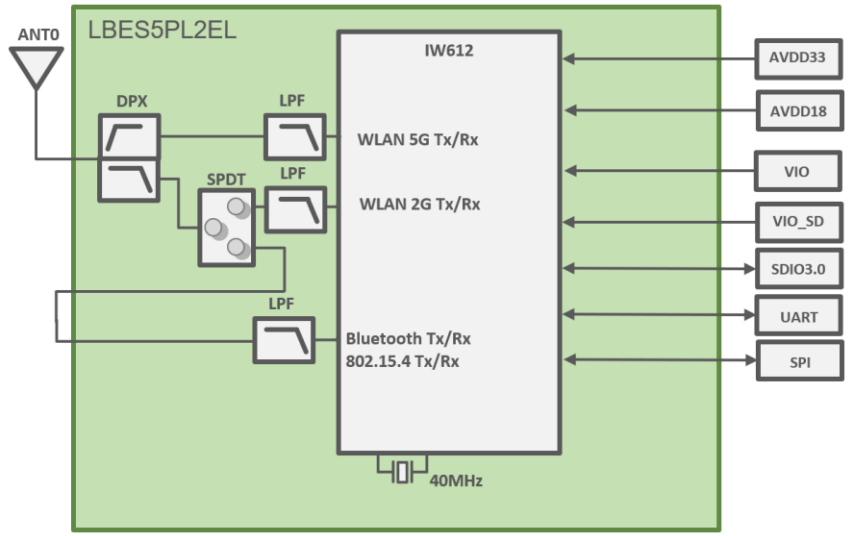
Part Number	Murata Part#	LBEE5PL2EL
Chipset	Wi-Fi/Bluetooth	NXP IW612
Features	Wi-Fi	IEEE802.11a/b/g/n/ac/ax
	Bluetooth version	5.3 (Dual)
	802.15.4	Supports Thread
	Interface	SDIO 3.0 (WLAN) , UART (BT) SPI (802.15.4)
	Dimensions L x W x H (mm)	7.7 x 8.8 x 1.3 (typ)
	Shielding	Shielded Resin
	Operating Temp. (°C)	-40 to +85
Certification	Regulatory Certification	Underway
	Bluetooth QDID	202018
Schedule	Sample	Available
	MP	Q2/2023

Top View

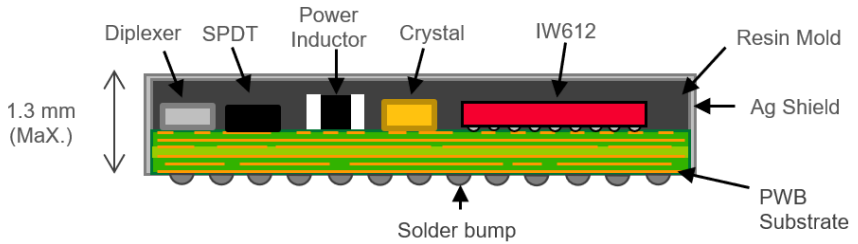
Bottom View



Block Diagram



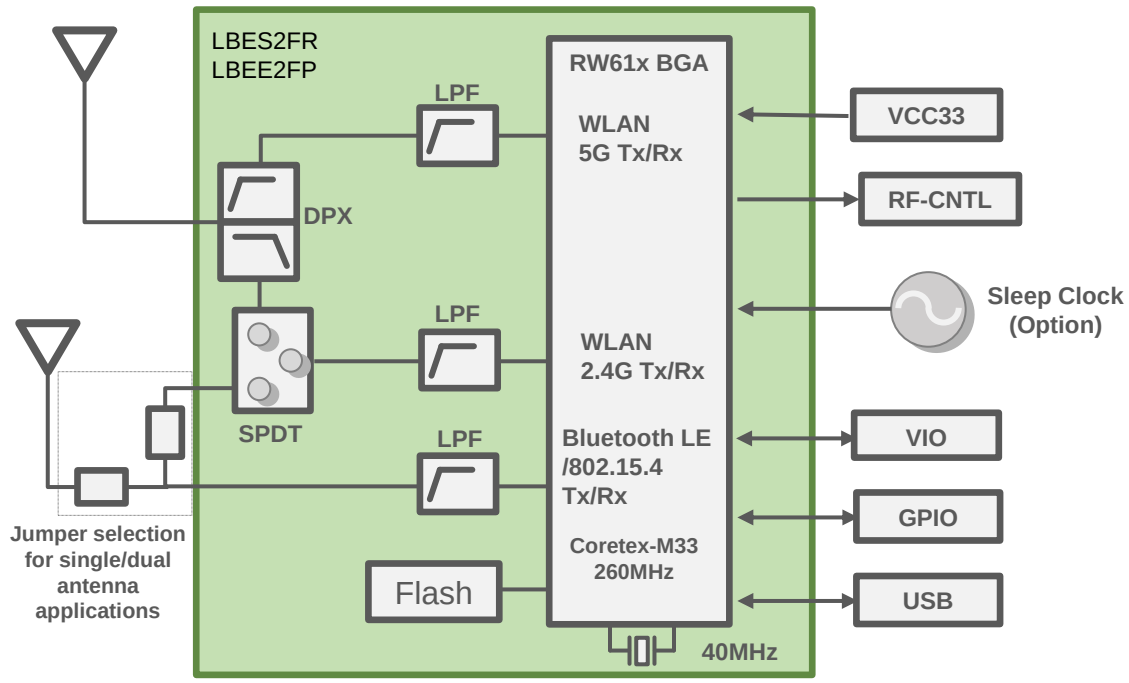
Cross-Sectional Diagram



Type 2FR/2FP: MCU + 11a/b/g/n/ac/ax + BLE 5.3 + (Thread)

Part Number	
Part Number	LBES0ZZ2FR LBEE0ZZ2FP
Chipset	
Chipset	NXP RW612 (for Type 2FR) NXP RW610 (for Type 2FP)
Features	
MCU	260 MHz Arm® Cortex® -M33
WLAN	IEEE802.11a/b/g/n/ac/ax
Bluetooth LE	v5.3 Class 2
802.15.4	OpenThread
Interface	Ethernet 802.3 (wired), SDIO 3.0 (WLAN) USB-OTG, I2C, I2S, SPI, USART
Antenna	RF signal from pin pad
Dimensions L x W x H (mm)	12.0 (Typ.) x 11.0 (Typ.) x 1.5 (Max.)
Package type	LGA
EMI shielding	Conformal SR Molding
Operating temperature (℃)	-40 to 85
Software platform	NXP MCUXpresso
Certification	
Regulatory Certification	FCC/ISED/ESTI/MIC (Plan)
Bluetooth QDID	TBD
Schedule	
Sample	Contact Murata (P/N: LBES2FR-SMP)
MP	Q4/2023

Block Diagram



Cross-Sectional Diagram