

Tech Talks LIVE Schedule – Presentation will begin shortly



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 Thunderboard™ Sense 2 kit.



Find Past Recorded Sessions at:
<https://www.Silicon Labs.com/support/training>



WELCOME



Silicon Labs LIVE:

Wireless Connectivity Tech Talks



RF Regulatory and Qualifications Testing for Bluetooth, Zigbee & Z-Wave

MAY 12, 202 - MARIUS TURCULET, FIELD APPLICATIONS ENGINEER



Agenda

- Overview
- RF regulatory certification
- Standards Certification
 - Bluetooth Qualification
 - Zigbee 3.0 Certification
 - Z-Wave Certification

A Complete Solution for Enabling Wireless Products

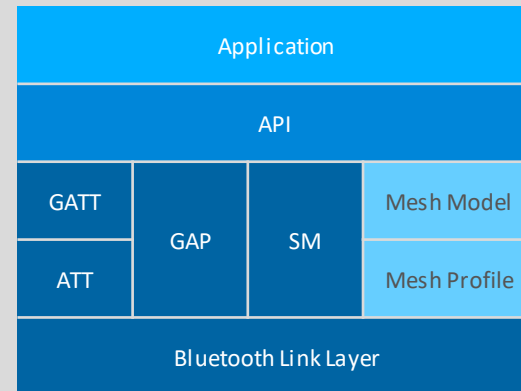
SoCS AND MODULES



Industry leading wireless SoCs and certified modules

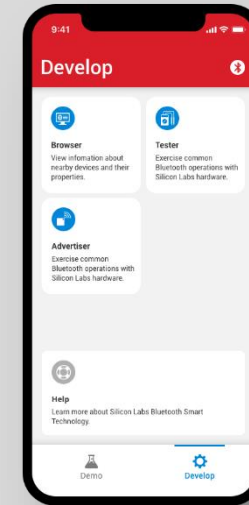


STACK SOFTWARE



In-house developed stacks with latest features

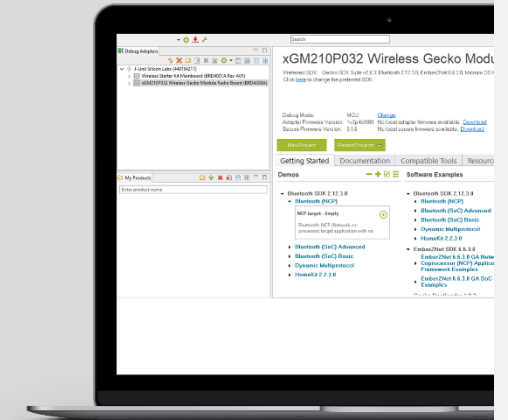
MOBILE APPLICATIONS



Reference apps 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 Complete Solution for Enabling Wireless Products

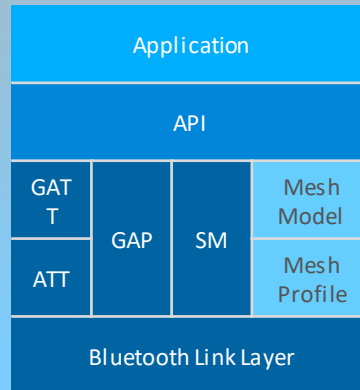
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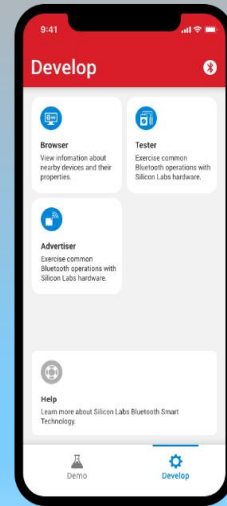


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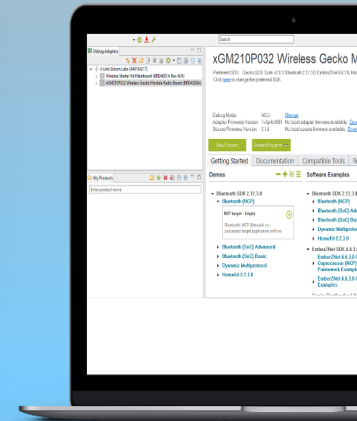
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Free-of-charge development and protocol analysis tools to boost productivity

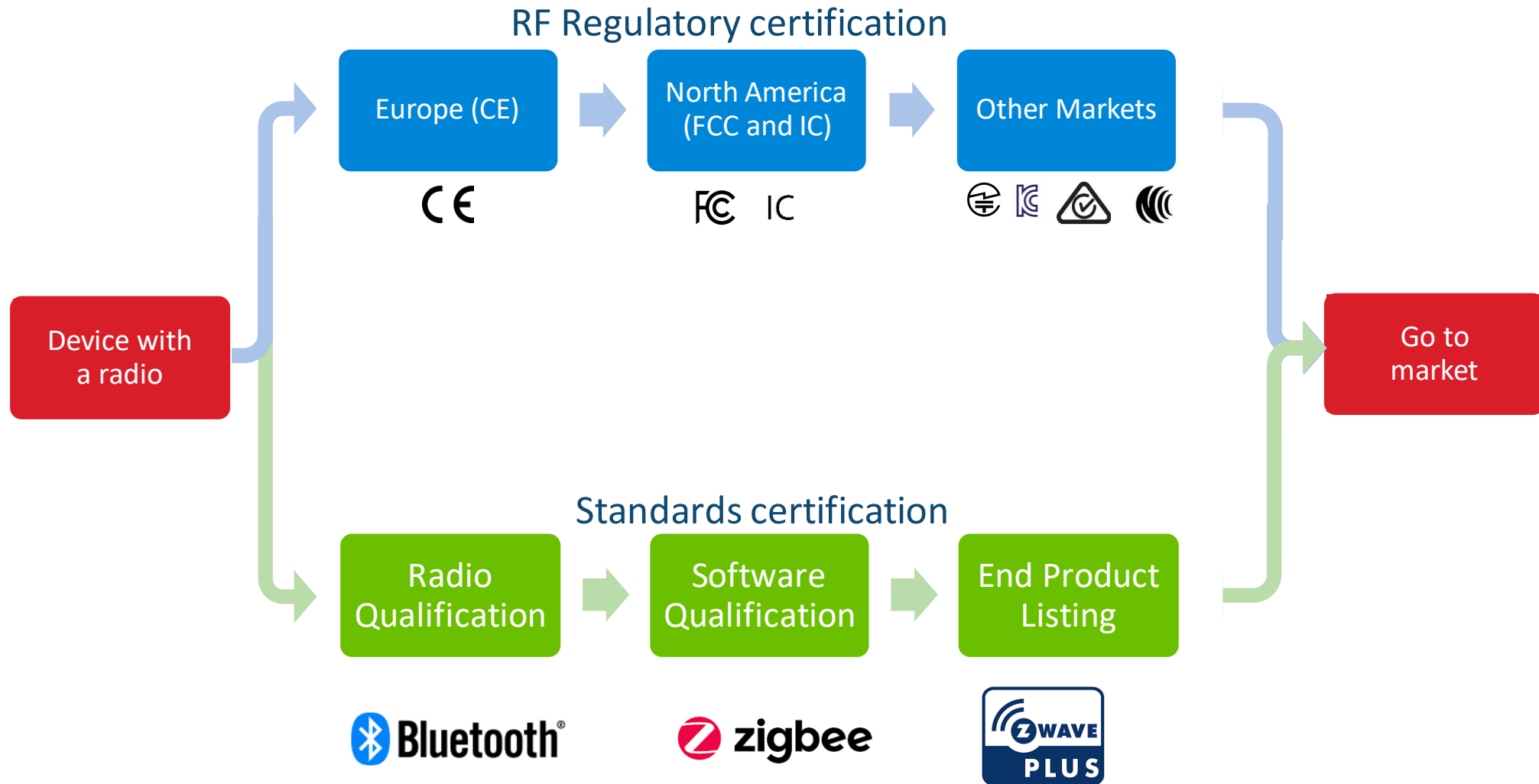


QUALIFICATION AND CERTIFICATION EXPERTISE



Certified stacks
Certified modules
Test Reports
Layout files
Application notes
User Guides

Process for Wireless Certification





RF Regulatory Certification



RF Certification Terminology / Acronyms

- C1PC = Class 1 Permissive Change – applies to modular approval (LMA, FMA) and relates to changes not increasing emissions
- C2PC – Class 2 Permissive Change – applies to modular approval (LMA, FMA) and relates to changes increasing emissions or changes to remove particular grant restrictions (antenna type, RF layout change, radio co-location)
- CB = Certification Body – a person authorized by the specific authority to review applications and admit certificates
- DoC = Declaration of Conformity – mandatory self-declaration written under full responsibility by the manufacturer stating product compliance
- DUT / EUT = Device Under Test / Equipment Under Test
- EU-TEC = EU Type Examination Certificate – optional document confirming directive conformity and compliance by testing against harmonized standards (also commonly known as the NB Opinion); provides statement by NB that TCF is appropriate for DoC
- GMA = Global Market Access – service offered by test houses to help manufacturers cover global certification needs; applying re-use of certification in countries which not certified for
- FMA = Full Modular Approval – meets criteria set for full modular certification
- LMA = Limited Modular Approval – does not meet criteria set for full modular certification
- NB = Notified Body – an organization designated by an EU country to assess the conformity of certain products before being placed on the market
- OEM = Original Equipment Manufacturer – in the context of certifications, this is an end-product producer as opposed to component vendor
- RED = Radio Equipment Directive – EU directive 2014/53/EU for compliance of radio equipment
- TCB = Telecommunication Certification Body – issues grants for equipment subject to certifications
- TCF = Technical Construction File – technical documentation for a product providing evidence of compliance (test reports, declarations) and conformity to a relevant regulation; also includes technical design material
- VSWR = Voltage Standing Wave Ratio – measure of how efficiently power is transmitted through a transmission line into a load

RF Regulatory Certification

- WHY?
 - Ensures the RF product operates as intended in its intended environment
 - Sensitivity
 - Adjacent, alternate or co-channel selectivity
 - Blocking
 - Ensures the RF product does not disturb other electronic or RF devices
 - The conducted and radiated power are under the standard limits
 - Harmonics and spurious emissions are under certain levels
 - Occupied bandwidth is well controlled
 - Spectral Power Density under limits

RF Regulatory Bodies

- USA: FCC
- Canada: ISED
- Japan: MIC
- South-Korea: KCC
- Taiwan: NCC
- Brazil: Anatel

■ Certification

- Testing at accredited lab
- OEM or its agent submits application to a CB
- CB approves application, sends certification and uploads into database
- Silicon Labs modules certified for USA, Canada, Japan, Korea
- End products can inherit module approval



- Europe: CE
- Australia : ACMA – RCM
- New Zealand: RSM

■ DoC

- Testing at accredited lab (not mandatory)
- OEM will file test evidence to an internal compliance folder
- OEM signs DoC stating standards compliance (RED)
- NB not involved unless testing is outside standards
- Silicon Labs provides our own DcC and test reports for modules.



- China: SRRC
- Russia: FAC

■ Restrictive markets

- Difficult to access
- Silicon Labs does not provide certifications

Customer Selection of Silicon Labs Solution

- **SoC**

- 100% on your own, RF design experience required, lowest device cost
 - EFR32BG22 SoC customer design with PCB antenna



- **Uncertified module**

- High certification cost, RF design experience not required
 - ZGM130S SiP PCB module customer design
 - Silicon Labs provides evidence/test report showing passing test results (only for EU, US, Japan, Korea)



- **Certified module (LMA)**

- Extra certification cost, RF design experience not required
 - BGM121 SiP PCB module customer design
 - LMA due to lack of shield requiring extra testing and C2PC

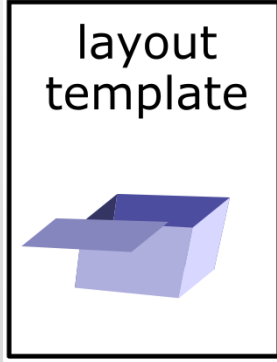


- **Certified module (FMA)**

- Low certification cost, RF design experience not required
 - BGM13S SiP module customer design
 - BGM13P PCB module customer design



Silicon Labs Documentation for Customers

DATASHEETS; APP NOTES	TEST REPORTS	INSTALLATION GUIDE	LAYOUT TEMPLATE
Minimal regulatory information except that which is required by regulatory bodies 	Zip packages for region or authority containing various PDF reports for customer reference 	Detailed layout guidelines, including dimensions Possibly includes FCC “test list” help Possibly includes other general regulatory advice 	File that is importable into a CAD design on a non-printable layer that shows outlines and dimensions that would help OEMs 
The datasheet include FMA. AN1048 – Regulatory RF Module certifications	Technical Resource Search / Misc category; BGM13S report list here	e.g. UG395 for WFM200	Schematic, Layout and Gerber files available on Silicon Labs website.
RF Certification Process and Regulation Requirements training			



Standards Certification



Standards certification

- WHY?

- Verify conformance to the standard
- Promote interoperability
- License IP/technology
- Access logo and marking rights
- Branding and promotion on Alliance/SIG website





Bluetooth Qualification



What is Required?

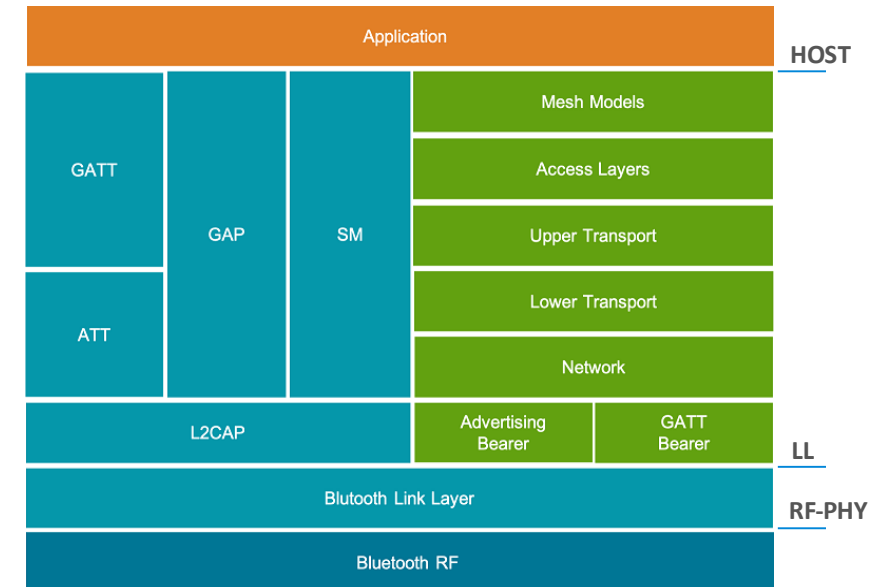
- A Bluetooth Qualification requires a few components

- RF-PHY
- Link Layer
- Host stack
- Mesh Profile and Mesh Model (BLE Mesh only)

- Pre-qualified QDIDs

- End Product Listing

- Qualifications can be done on each component, sub-systems (modules) or end products.



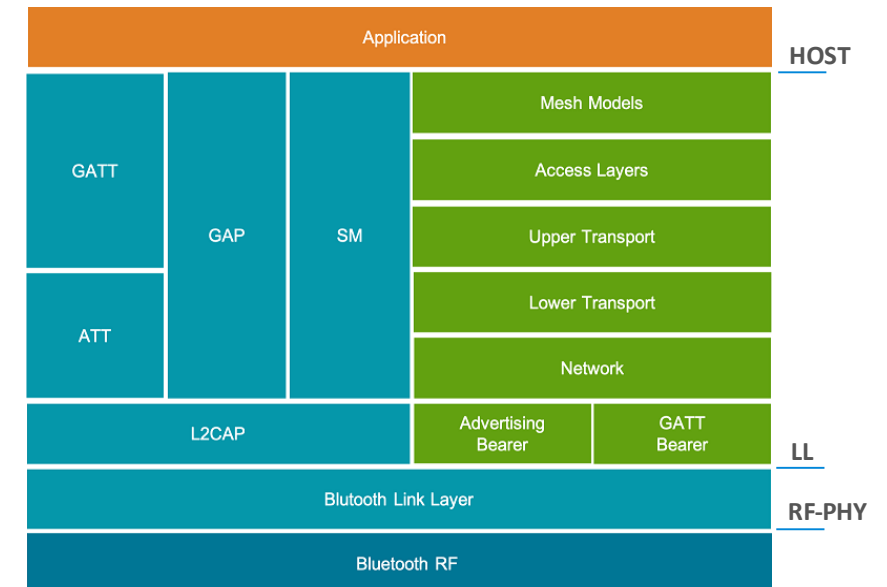
RF-PHY qualification

- Verifies radio conformance with the BT standard
- Modules datasheet contains the applicable RF-PHY QDID:

11.2 Bluetooth

The BGM13S is pre-qualified as a Low Energy RF-PHY tested component, having Declaration ID of D039577 and QDID of 119769. For the qualification of an end product embedding the BGM13S, the above should be combined with the most up to date Wireless Gecko Link Layer and Host components.

- SoCs qualifications using the radio boards



D044525

146980 - Component (Tested)

Silicon Laboratories

EFR32BG22, EFR32BG22x
EFR32MG22, EFR32MG22x

5.2

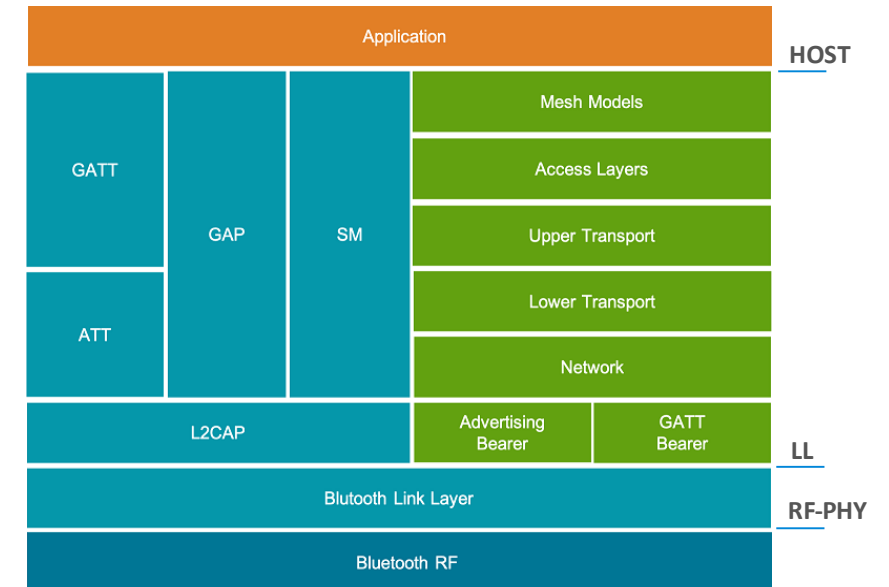
2020-03-16

- Qualifications can be re-used if design matches our radio board
- Significant changes require new RF-PHY qualification through and [accredited test house](#)
- [Qualification consultants](#) can help customers through the process

Host and Link Layer qualifications

- Verifies software stack conformance with the specification
- Applicable to the SW stack (SDK) and not to ICs
- QDIDs for Link Layer and Host stack can be found in [QSG139](#).

Bluetooth SDK version	Component	QDID
v1.x	Link layer (Bluetooth 4.2)	81105
	Host stack (Bluetooth 4.2)	82817
v2.0 to v2.4.x	Host stack (Bluetooth 4.2) • To be used in combination with SDK v1.x link layer qualification (QDID 81105)	91422
v2.6.x to 2.10.x	Link layer (Bluetooth 5.0) [*]	99504
	Host stack (Bluetooth 5.0) [*]	101550
v2.10.x to 2.13.x	Link Layer (Bluetooth 5.0 – including coded PHYs)	124272
	Link Layer (Bluetooth 5.1)	127618
	Host stack (Bluetooth 5.1)	126252
v2.13.x and above	Link Layer (Bluetooth 5.2)	147971[**]
	Host stack (Bluetooth 5.2)	146950



- Also on [BT SIG website](#):

Declaration ID	QDID(s)	Company	Products	Specification Name	Listing Date
D049533	147971 - Component (Tested)	Silicon Laboratories	Wireless Gecko Link Layer based on Core Specification 5.2, Wireless Gecko Link Layer based on Core Specification 5.2	5.2	2020-04-03

Bringing it all together - End Product Listing

- Requires BT SIG membership
 - Free associate membership
 - Adopter \$7,500 / \$35,000
- End Product listings fees
 - \$4,000 associate member
 - \$8,000 adopter member
- Demonstrates compliance from PHY to application protocols
 - Core specification 5.2
- Full listing process through [Launch Studio](#)
 - Submitting all test evidence to the BT SIG
 - Silicon Labs QDIDs used
 - [Getting started check-list](#)
 - [Launch Studio Start Guide](#)
- [Silicon Labs Video guide](#) on Bluetooth Qualification

Bringing it all together - End Product Listing –Launch Studio



[Back to Draft Projects](#)

New project

Project Basics Layer Selection ICS Selection Testing Test Documentation Product Declaration Declaration ID Review & Submit

Qualification Project with Required Testing

[Get help on this step](#)

Project Name *

my_first_lot_design

Previously Qualified Design Used in this Qualification

Search by QDID

?

If you don't have this number, ask your supplier or [Search Listings](#).

88831 | Component (Tested) | BGM121 | Silicon Laboratories

×

127618 | Component (Tested) | Wireless Gecko Link Layer based on Core Spec

×

126252 | Component (Tested) | Wireless Gecko Host based on Core Specification

×

TCRL Version *

☒ TCRL 2019-1 (Recommended)

☐ TCRL 2018-2 (Active 2019-01-28 to 2019-11-19)

Product Types *

☐ [1/1] End Product

☐ [1/2] Component

☐ [1/3] Component

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Stop sharing

Hide

Bringing it all together - End Product Listing

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 - [Getting started check-list](#)
 - [Launch Studio Start Guide](#)
- [Bluetooth Qualification Process](#)





Zigbee Certification

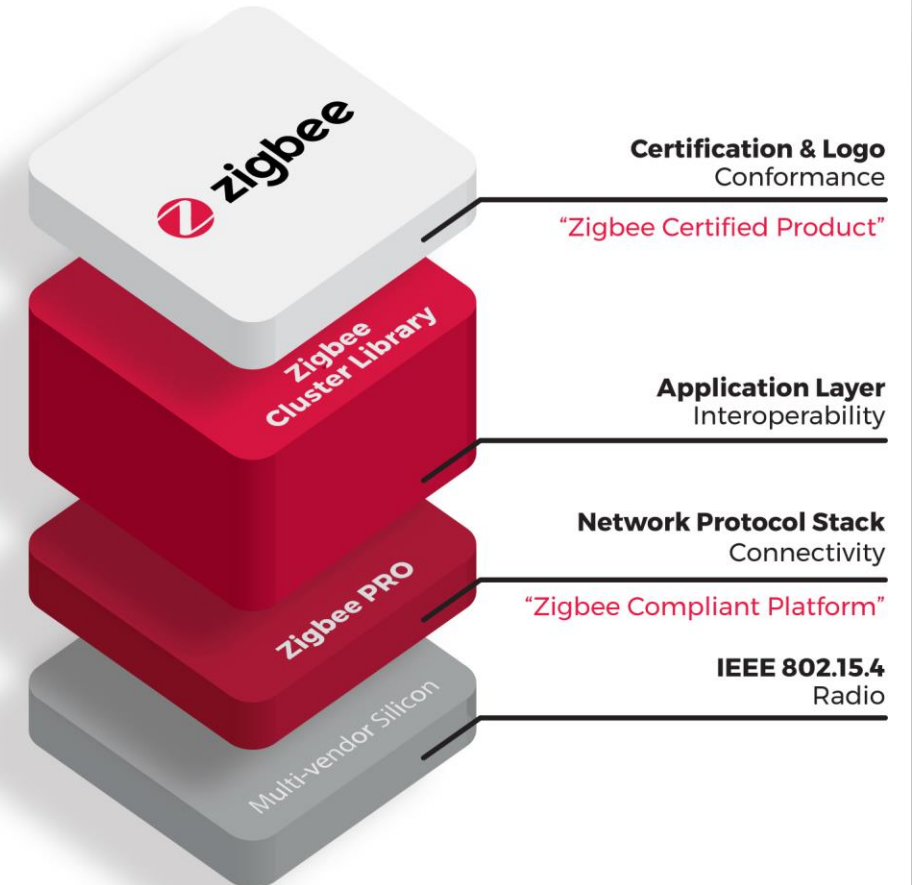


What is Required?

- 802.15.4 MAC/PHY Testing
 - Verifies compliance with the 802.15.4 specification
 - Silicon Labs certifies each chip family
- Zigbee Compliant Platform
 - Verifies stacks (EmberZNet) conformance with Zigbee networking
 - Silicon Labs certifies each chip family with each stack release.
 - Certificates available through [Alliance website](#)



- Zigbee Certified Product



Zigbee Compliant Platform

Zigbee Compliant Platforms

All Zigbee Compliant Platforms

Zigbee PRO

Zigbee PRO + Green Power

Zigbee RF4CE

Zigbee 3.0 Ready

Zigbee Smart Energy Ready

search

reset

Showing 1-25 of 326 [export](#)

25 per page

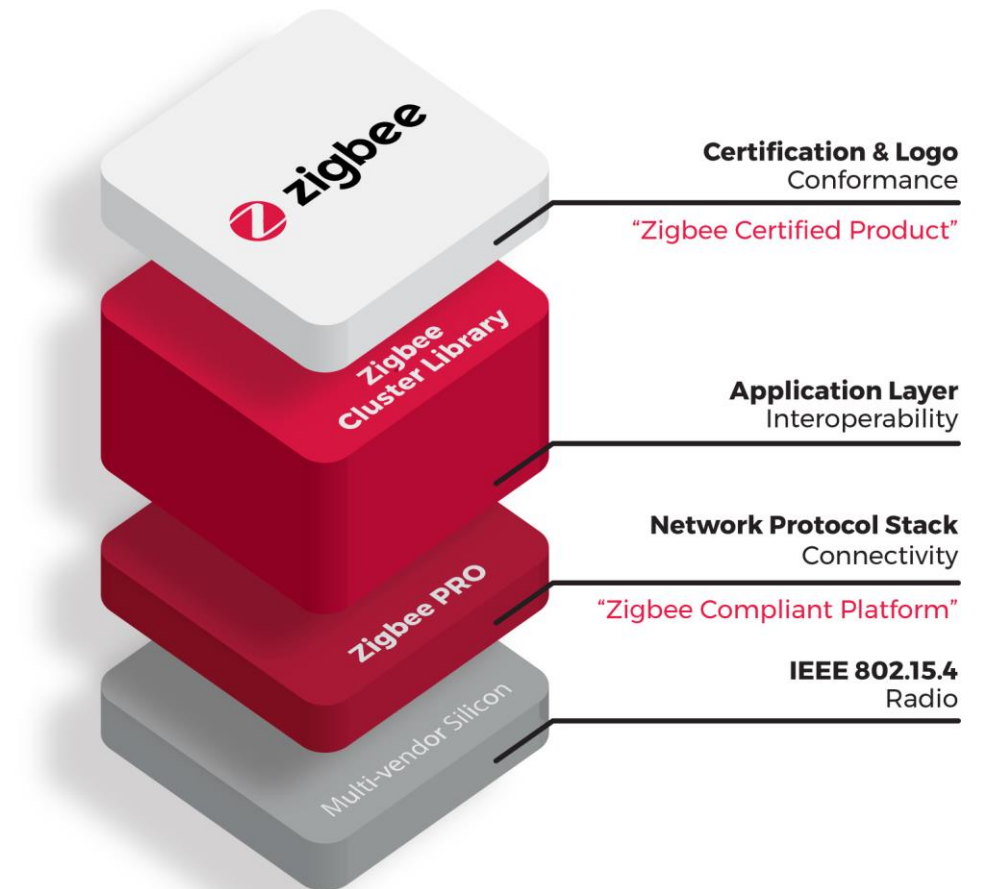
Page 1 of 14

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Company	Platform Name	Revision	Firmware Version	Hardware Version	Feature Set	Certificate ID	Certified Date
Silicon Labs	EFR32MG21x	12	EmberZNet 6.7.0	EFR32MG21x Family	Zigbee PRO Compliant Platform (2017), Green Power Proxy Basic	ZIG20015ZCP27236-24	02/26/2020

Zigbee Certified Product

- Verifies cluster library and application layer conformance
 - Zigbee 3.0 (r22)
- In-house pre-testing strongly suggested
 - Zigbee Test Tool (ZTT)
 - Zigbee Test Harness
- Declaration of Conformity (DoC)
- Protocol Implementation Conformance Statement (PICS)
 - BDB and individual cluster PICS
 - Mandatory and optional features supported
 - Describe functionality of your specific device
 - Clusters, commands attributes supported
- [AN1118: Certifying Zigbee 3.0 Devices](#)
- [KBA: Steps to Zigbee Certification for Wireless Mesh Products](#)
- [Zigbee Certification Process training](#)



zigbee

Zigbee Test Tool

v 1.0.2.5

Checking Installation

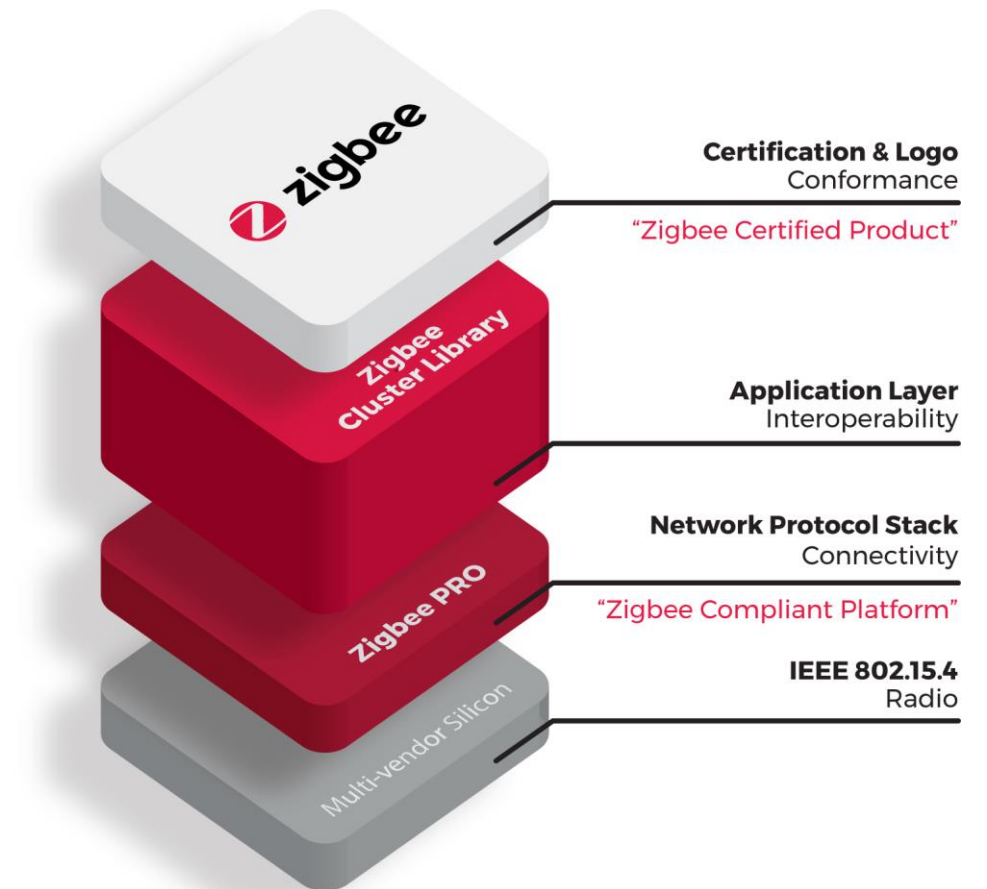
www.zigbee.org

Zigbee Certified Product –Zigbee Test Harness (ZTH)



Zigbee Certified Product

- Verifies cluster library and application layer conformance
 - Zigbee 3.0 (r22)
- In-house pre-testing strongly suggested
 - Zigbee Test Tool (ZTT)
 - Zigbee Test Harness
- Declaration of Conformity (DoC)
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- [AN1118: Certifying Zigbee 3.0 Devices](#)
- [KBA: Steps to Zigbee Certification for Wireless Mesh Products](#)
- [Zigbee Certification Process training](#)



Zigbee Certified Product - PICS



Base Device Behavior PICS Proforma Version 1.0

ZigBee Document 15-0283-04	
April 18th, 2015	
Sponsored by: ZigBee Alliance	
Accepted by	This document has been accepted for release by the ZigBee Alliance Board of Directors
Abstract	This specification defines the base device behavior specification for devices operating on the ZigBee-PRO stack, ensuring profile interoperability between application profiles.
Keywords	Base device, profile interoperability, ZigBee-PRO, PICS

5 General requirements

5.1 [ZLT] ZigBee logical device types

Item number	Feature	Reference	Status	Support
ZLT1	Is the logical device type specified as a ZigBee coordinator?	[R1]/2.5.4.5.1	O.1	Yes No
ZLT1.1	Does the node encompass the role of the Trust Center?	6.1	ZLT1: M ZLT2: X ZLT3: X	Yes No
ZLT1.2	Does the node form a centralized security network?	6.1	ZLT1: M ZLT2: X ZLT3: X	Yes No
ZLT1.3	Does the node NOT attempt to join another network?	6.1	ZLT1: M	Yes /No
ZLT2	Is the logical device type specified as a ZigBee router?	[R1]/2.5.4.5.2	O.1	Yes /No
ZLT2.1	Can the router node join another network?	6.1	ZLT2: M	Yes /No
ZLT2.2	Does the node form a distributed network?	6.1	ZLT1: X ZLT2: O ZLT3: X	Yes /No
ZLT3	Is the logical device type specified as a ZigBee end device?	[R1]/2.5.4.5.5	O.1	Yes /No
ZLT3.1	Can the end device node join another network?	6.1	ZLT3: M	Yes /No
ZLT3.2	Is the end device sleepy?	-	ZLT3: O	Yes /No
ZLT4	Can the node switch between ZLT1 and ZLT2 types under application <u>control</u> .	6.1	O.1	Yes /No

Bringing it all together – Zigbee Certified Product

- Requires Zigbee Alliance membership
 - \$7,000 for adopter
 - \$15,000 for participant
 - \$75,000 for promoter
- Zigbee Certified Product fees
 - \$1,000 per new product
- Choose a Zigbee Compliant Platform (Ember Znet)
- Select an [Authorized Test House](#)
- Send Documentation and product to Test House for Certification
 - Declaration of Conformity
 - Protocol Implementation Conformance Statement (PICS)
- Submit documents to Zigbee Alliance via [Certification Web Tool](#)





Z-Wave Certification



What is Required?

- A Z-Wave Qualification has 2 components:

- Technical Certification

- Owned and maintained by Silicon Labs



- Market Certification

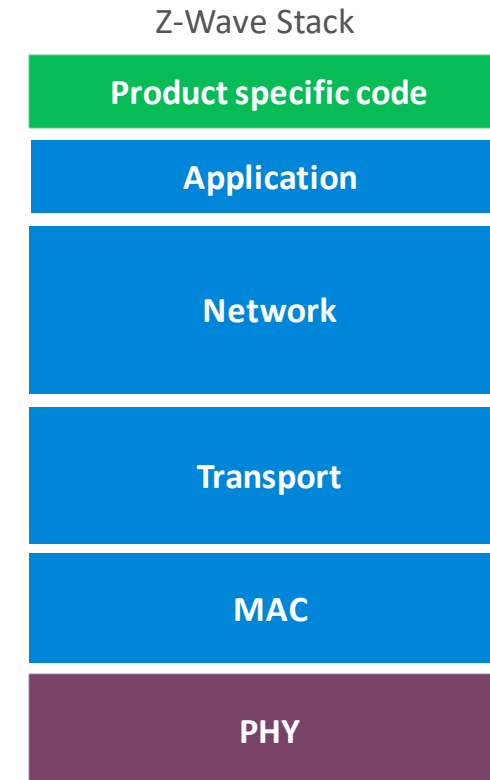
- Owned and maintained by Z-Wave Alliance



Technical Certification

- [Z-Wave Certification Portal](#)

- Certification case and Certification form
 - Product details
 - Technical details on supported functionality, roles
 - Test house
- Self-certification tests
 - Z-Wave Compliance Test Tool (CTT)
- Submit information to Silicon Labs
 - Pass Initial Review
- Engage a test house
 - Start Market Certification



Technical Certification - Z-Wave Certification Portal

PI.3.1	↳ 700 Series	MS
	Product Information - Software	
PI.3.1.1	↳ Z-Wave Plus Developer's Kit version (API version) <i>New Z-Wave products can only be certified provided they are based on "Active or "Maintained" Z-Wave releases. Recertifications may also be based on or "Monitored" Z-Wave releases. ("Beta" and "Obsolete" Z-Wave releases cannot be used). Beta releases can be identified by a trailing "0" in the main branch identifier. Examples include 5.0<u>0</u>, 4.5<u>0</u> and 6.5<u>0</u> (the trailing zero is underlined). Please do not confuse this with a new active SDK like 4.55.00 or 6.51.00 where the "00" is used to identify it as the initial release.</i>	M
PI.3.1.1.1	↳ 7.12.1 (7.12) <i>Active Z-Wave release</i>	MS
PI.3.1.1.2	↳ 7.11.0 (7.11) <i>Maintained Z-Wave release - Allowed for new products until May 20th, 2020. May be used for re-certifications.</i>	MS

Technical Certification - Z-Wave Certification Portal

Save & Exit

Save & Validate

Previous

Next

Certification Data ✓

[DM] Development and Manufacturing ✓

[PI] Product Information

[DR] Device & Role Type

[DD] Device Data

Files

Items summary

Finalize

Item Number	Item Description	Status	Select	Comments
Certification Type				
PI.1	Type of Z-Wave Plus v2 Certification	M	☒	0/0/0
PI.1.1	New Z-Wave Plus v2 Certification New certifications MUST be based on Active or Maintained SDKs. This selection is for new devices, not a variation of a previously certified device (unless there are major changes being made). Please refer to the Certification Overview document for details and examples.	MS	☐	0/0/0
PI.1.2	Re-Certifications, all required conditions met Re-certifications MUST be based on Active, Maintained or Monitored SDKs.	? MS	☐	0/0/0
Product Type				
PI.2	Product Type	M	☒	0/0/0
PI.2.1	General Z-Wave Plus v2 Product Hardware and software of product are being certified	MS	☐	0/0/0
PI.2.2	Z-Wave Plus v2 Software Application Product Software is certified; requires Certified Z-Wave Platform product to run on	MS	☐	0/0/0
PI.2.3	Z-Wave Plus v2 Hardware Platform Product Hardware together with sample application software is being certified; must use and expose standard Z-Wave Plus v2 Serial API to host application (not a standalone end user product)	MS	☐	0/0/0
Product Information				
PI.3	Z-Wave Chipset Generation	M	☒	0/0/0
PI.3.1	700 Series	MS	☐	0/0/0
PI.3.2	500 Series	MS	☐	0/0/0

Technical Certification - Z-Wave Certification Portal

Save & Exit

Save & Validate

Previous

Next

Certification Data ✓

[DM] Development and Manufacturing ✓

[PI] Product Information ✓

[DR] Device & Role Type ✓

[MCE] Multi Channel End Points ✓

[DT] Device Type Requirements ✓

[RT] Role Type Requirements ✓

[CDR] Common Device Requirements ✓

[CCA] Application Command Classes ✓

[CCM] Management Command Classes

[CCT] Transport-Encap Command Classes

[CCN] Network-Protocol Command Classes

[CSR] Command Class Support Requirements

[CCR] Command Class Control Requirements

[SR] Security Requirements

[SSR] SmartStart Requirements

[RD] Required Documentation

[AGD] Association Group Data

[MSD] Multilevel Sensor Data

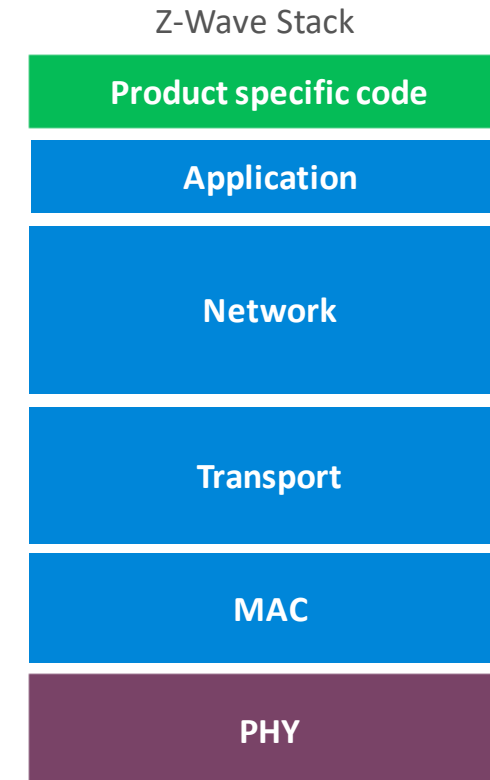
[ND] Notification Data

[DD] Device Data

Item Number	Item Description	Select	Role		Comments
			Support	Control	
CCM.1	Application Status Command Class	☐			0/-/-
CCM.2	Association Command Class	? ▼			0/-/-
CCM.2.1	↳ Association Command Class, Version 1 Note: Not Allowed for Z-Wave Plus				0/-/-
CCM.2.2	↳ Association Command Class, Version 2	☒	▼	▼	0/-/-
CCM.3	Association Command Configuration Command Class	☐			0/-/-
CCM.4	Association Group Information Command Class	? ▼			0/-/-
CCM.4.1	↳ Association Group Information Command Class, Version 1	☐	☐	▼	0/-/-
CCM.4.2	↳ Association Group Information Command Class, Version 2	☐	☐	▼	0/-/-
CCM.4.3	↳ Association Group Information Command Class, Version 3	☒	▼	▼	0/-/-

Technical Certification

- [Z-Wave Certification Portal](#)
 - Certification case and Certification form
 - Product details
 - Technical details on supported functionality, roles
 - Test house
 - Self-certification tests
 - Z-Wave Compliance Test Tool (CTT)
 - Submit information to Silicon Labs
 - Pass Initial Review
- Engage a test house
 - Start Market Certification



Technical Certification – Z-Wave Certification Tool (ZTT)

Home

Certification

Self Certification

Self Certification - Pepper One GmbH - Customer - Test Product (Pre-Cert)

Actions / Go To: View Certification

Save & Exit

Save & Validate

Previous

Next

[DM] Development and Manufacturing

[PI] Product Information

[DR] Device & Role Type

[MCE] Multi Channel End Points

[DT] Device Type Requirements

[RT] Role Type Requirements

[CDR] Common Device Requirements

[CCA] Application Command Classes

[CCM] Management Command Classes

[CCT] Transport-Encap Command Classes

[CCN] Network-Protocol Command Classes

[CSR] Command Class Support Requirements

[CCR] Command Class Control Requirements

[SR] Security Requirements

[SSR] SmartStart Requirements

[RD] Required Documentation

[AGD] Association Group Data

[MSD] Multilevel Sensor Data

[ND] Notification Data

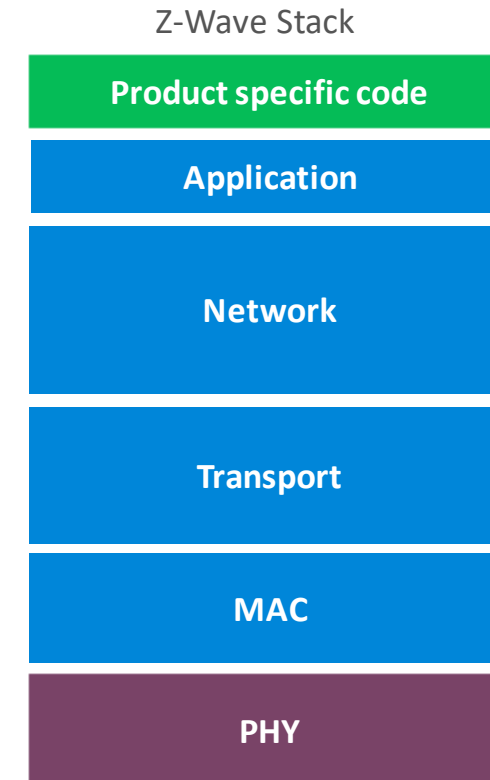
[DD] Device Data

[H] Hardware

Item Number	Item Description	Status	Select	Certification	Comments
				Self-Certification	
RT.8	Listening Sleeping Slave (LSS) The Listening Sleeping Slave Role Type is intended for battery-operated devices that can be reached even though they are sleeping thanks to Beaming (FLIRS devices). Examples include Door Locks and Battery operated Thermostats.	O/M	☒	☒ ☐ ☐	0/-/-
	LSS Protocol Requirements				
RT.8.1	The LSS MUST be battery powered and support the Battery Command Class. RT:08.11.0002.1	M	☒	☒ ☐ ☐	0/-/-
RT.8.2	The LSS MUST set the listening flag to 0 in its NIF. RT:08.11.0003.1	M	☒	☒ ☐ ☐	0/-/-
	LSS Runtime communication				
RT.8.3	The LSS MUST communicate via the lifeline association if any lifeline association exists. RT:08.11.0004.1	M	☒	☒ ☐ ☐	0/-/-
RT.8.4	The LSS MUST stay awake for at least 2 seconds after communicating. RT:08.11.0005.1	M	☒	☒ ☐ ☐	0/-/-
	SmartStart requirements				
RT.8.5	A Z-Wave Plus v2 node MUST either support to be included in a network using SmartStart inclusion or provide SmartStart inclusion of other nodes. DT:00.11.0026.1	M	☒	☐ ☐ ☐	0/-/-
RT.8.5.1	DUT supports SmartStart inclusion	M	☒	☒ ☐ ☐	0/-/-

Technical Certification

- [Z-Wave Certification Portal](#)
 - Certification case and Certification form
 - Product details
 - Technical details on supported functionality, roles
 - Test house
 - Self-certification tests
 - Z-Wave Compliance Test Tool (CTT)
 - Submit information to Silicon Labs
 - Pass Initial Review
- Engage a [test house](#)
 - Start Market Certification



Bringing it all together - Market Certification

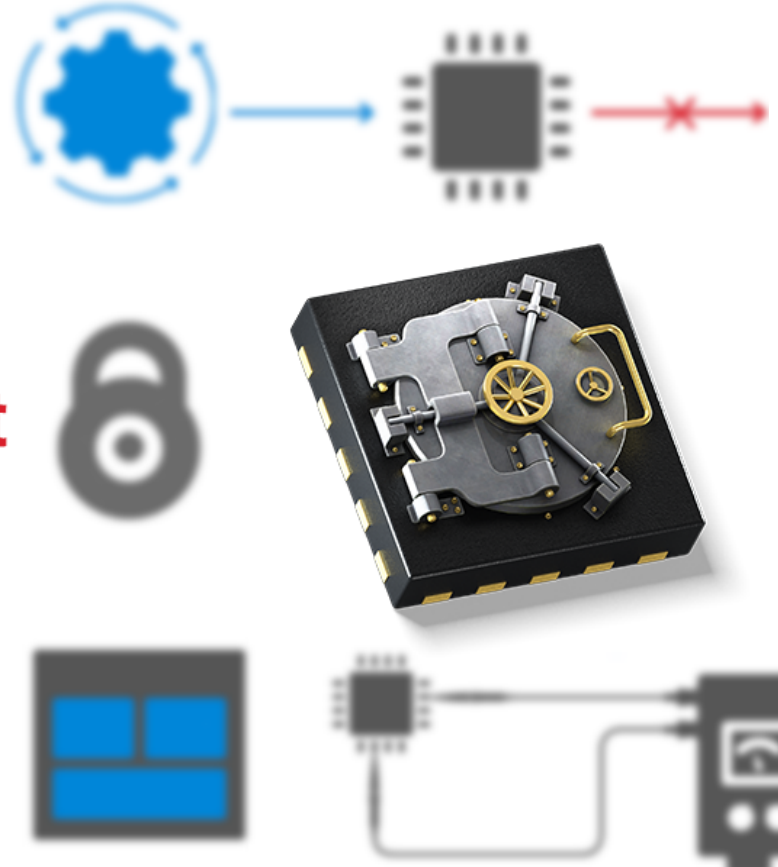
- Requires full membership in the Z-Wave Alliance
 - \$4,5000 annual membership
 - \$4,000 certification fee
- [Market Certification Portal](#)
- Identification and recognition focused
 - Z-Wave and Z-Wave Plus trademarks on product and packaging
 - Brand name on product
- Z-Wave Network Management information is displayed
 - Inclusion, Exclusion, Learn, Reset, Configuration, Association
- Z-Wave Certified Products Catalog
- Certification number
- [Z-Wave Certification Process](#)



Join Us: Security in IoT – Secure Vault Webinar

Security in IoT: Introducing Secure Vault

Wednesday, May 13th
11am CDT



Mike Dow

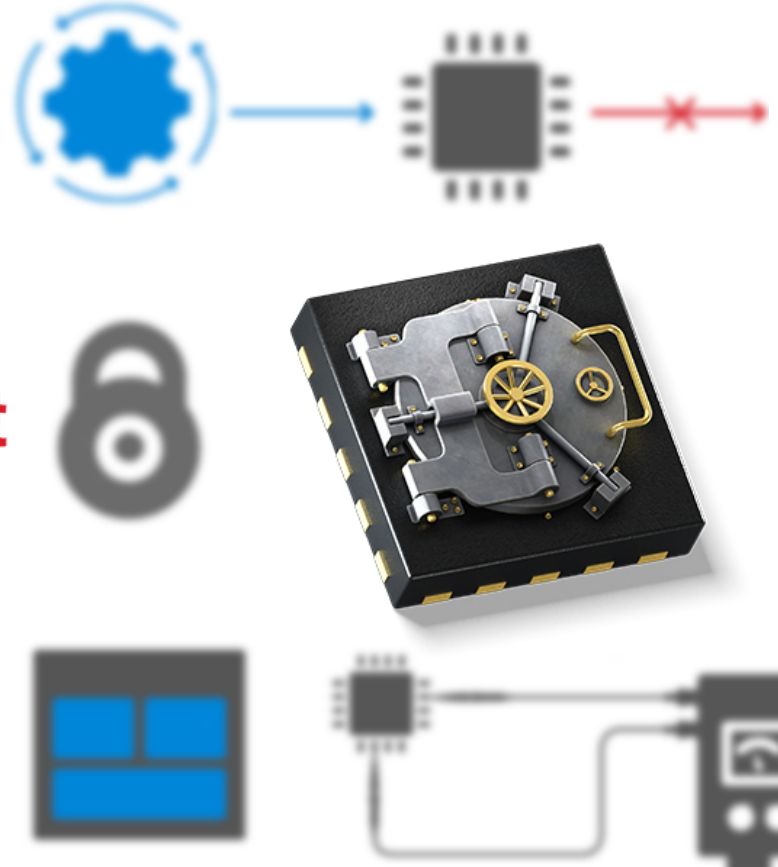
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Thank you

MARIUS TURCULET - MAY 12, 2020



Appendix A: Countries following the CE standard

- EU countries
- ETFA countries – Iceland, Norway, Switzerland (and Liechtenstein)
- French DOMs
- Guadeloupe, Martinique, French Guiana, Reunion
- Afghanistan
- Andorra
- Georgia
- Gibraltar
- Maldives
- Monaco
- San Marino
- Sao Tome and Principe
- Seychelles
- Vatican City
- Faroe Islands
- Greenland
- Svalbard
- Azores
- Madeira
- Canary Islands
- Guernsey
- Jersey
- Isle of Man
- Montserrat
- Pitcairn Islands



Appendix B: Countries following the FCC standard

- Anguilla
- American Samoa
- Bolivia
- Cayman Islands
- El Salvador
- Federated States of Micronesia
- Guam
- Guatemala
- Marshall Islands
- Northern Mariana Islands
- Palau
- Panama
- Puerto Rico
- Virgin Islands (US)



Appendix C: RF Regulatory Test Houses

Test House	Url for Worldwide Locations
SGS (Standard Global Services)	https://www.sgs.com/en/office-directory
Bureau Veritas	http://www.us.bureauveritas.com/home/worldwide-locations/locations
Dekra	https://www.dekra.com/en/dekra-worldwide/
Element	https://www.element.com/locations
TUV-SUD	https://www.tuvsud.com/en-us/locations#/
NCC Certificações do Brasil	www.ncc.com.br www.ncc.org.br

- This list includes test houses Silicon Labs has been using recently for module certification efforts