Smart home appliances –
Overview of connectivity solutions

February 2023

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The challenge: Making smart products is hard

Creating a delightful user experience

› 100% of consumers want smart-home products and services that make life safer and easier
› Small shift in customer reviews has a large impact on sales
› "One positive star on Amazon increases sales by 20%"

Better experience and easier products

100%

Improving connectivity of your products

› "60% of consumers fail to onboard smart home devices"
› On average, 40% of onboarding failures last between 8 min – 60 min
› Most customers give up trying to connect their device after 2 failed attempts

Connectivity problems

60%

While reducing costs

› "43% of organizations fail to finish a project within the original budget"
› "Number of product managers who want more resources for their projects: 100%"

Fail to finish on budget

43%

Core capabilities to solve key design challenges

Intuitive Sensing Capabilities

Intuitively sensing the environment as with human-like senses for a more meaningful contextual awareness. **Ubiquitous sensors** mark the "point of beginning" of the IoT, picking up meaningful data from the environment surrounding an IoT edge device.

Reliable Connectivity

Providing **stable and secure connections** at lowest power consumption Wi-Fi, Bluetooth and BLE USB / USB-C.

Trusted Security

Security solutions shield connected systems and devices and protect personal privacy, intellectual property and public safety. Comprehensive security portfolio from dedicated security hardware to integrated solutions.

Flexible Processing

Microcontrollers are the **brain of IoT systems**. They control and instruct IoT devices by collecting, coordinating, processing, analyzing, and communicating data – thus making them "**smart**" at lowest power consumption.

Complete Software Ecosystem

For easy implementation of complete IoT systems: Embedded software development tools for flexible configuration, fast and easy programming of microcontrollers, implementation of cloud services, (OTA updates and data security); (Connectivity SDKs).

Efficient Power Management

The power supplied is constantly managed smartly and efficiently. Lights, temperature and movements are controlled and actuated by intelligent power management together with power semiconductors.

Sense · Compute · Connect · Actuate · Secure

Create – Software Ecosystem
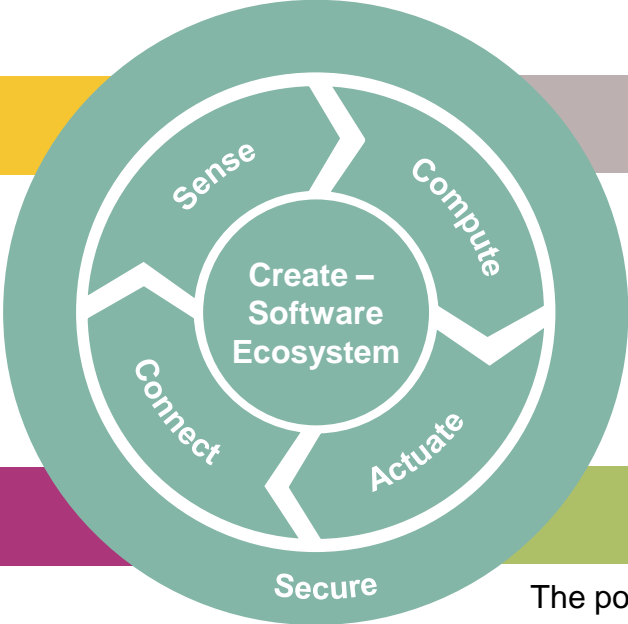
Infineon is the ideal partner for Innovative Smart Home IoT Solutions

Helping customers bring
high-quality, differentiated smart home products to market
on time, on budget, with low risk

Best-in-class HMI

High Performance Bluetooth

Secure & Reliable Wi-Fi

Low-Power Secure MCU

Innovative Sensing

Infineon Proprietary

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Infineon Proprietary

Broad AIROC™ Family Delivers Powerful Wi-Fi for your application

Reliable

› **Most widely deployed wireless IP** – more than 1 Billion AIROC™ Wi-Fi and Bluetooth® devices in the field

› **Best interoperability** with installed base of Access Points and data-driven Wi-Fi algorithm improvement

› **Strength in Bluetooth® classic complements Wi-Fi** in streaming applications to ensure reliability.
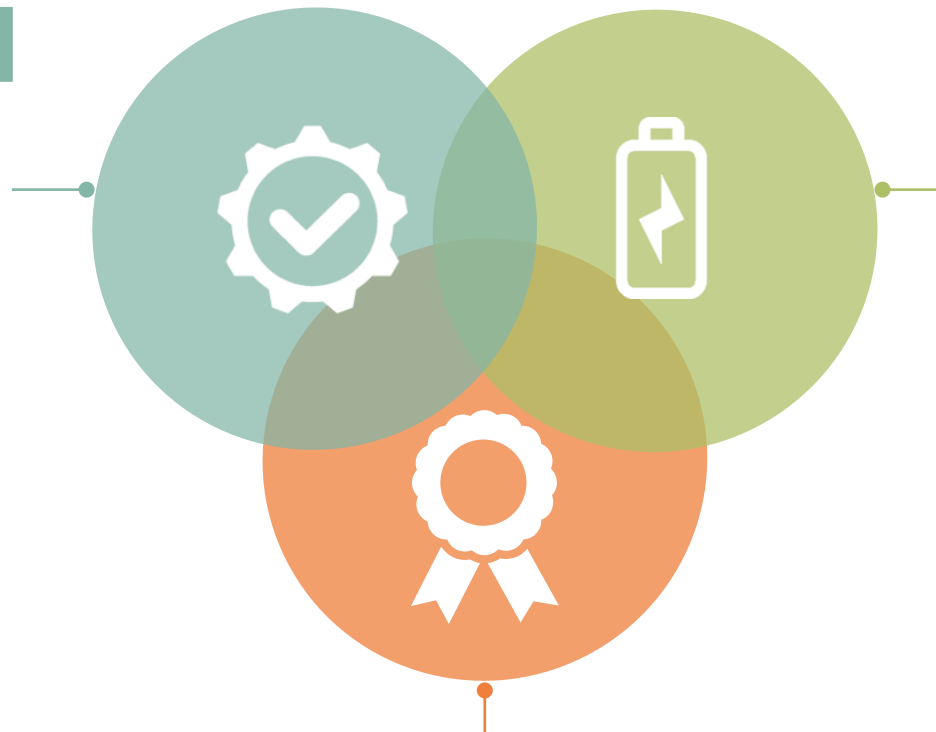
Low Power

› **Ultra low power by design** – very low sleep, transmit, and receive current

› **Low power system architecture** – host offloads for keep-alive functions allowing host processor to sleep for longer periods

› High-performance RF ensures the **most robust connection** which substantially reduces power consumption

› **Data-driven Wi-Fi** with 300M datapoints per day for proven low power in real-world conditions

High Performance

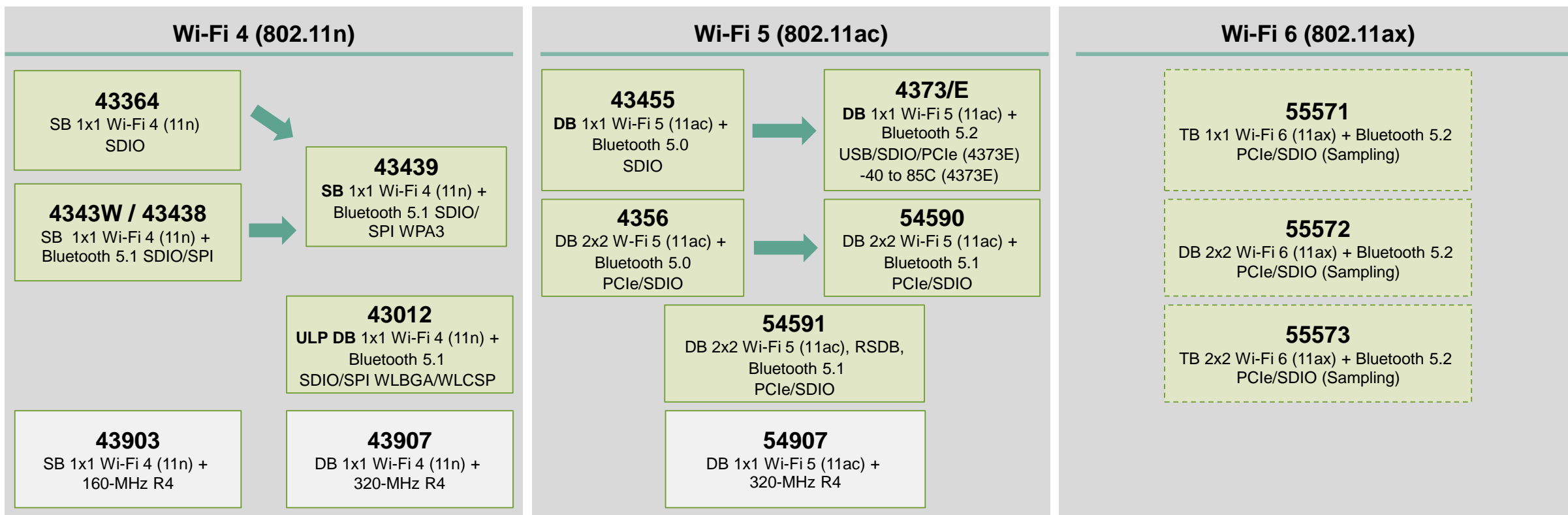› High-performance RF design ensures your device works when needed in increasingly congested environments due to **longer range** (more than double some competitors)

› Industry's best **Coex performance**: configuration options per antenna design and system-level use cases

› Real-Time Simultaneous Dual Band enables **demanding applications** requiring connection to an AP and a local network of devices

Infineon AIROC™ IoT Wi-Fi Portfolio

Wi-Fi 4 (802.11n)

43364
SB 1x1 Wi-Fi 4 (11n)
SDIO

4343W / 43438
SB 1x1 Wi-Fi 4 (11n) +
Bluetooth 5.1 SDIO/SPI

43439
SB 1x1 Wi-Fi 4 (11n) +
Bluetooth 5.1 SDIO/
SPI WPA3

43012
ULP DB 1x1 Wi-Fi 4 (11n) +
Bluetooth 5.1
SDIO/SPI WLBGA/WLCSP

43903
SB 1x1 Wi-Fi 4 (11n) +
160-MHz R4

43907
DB 1x1 Wi-Fi 4 (11n) +
320-MHz R4

Wi-Fi 5 (802.11ac)

43455
DB 1x1 Wi-Fi 5 (11ac) +
Bluetooth 5.0
SDIO

4356
DB 2x2 W-Fi 5 (11ac) +
Bluetooth 5.0
PCIe/SDIO

4373/E
DB 1x1 Wi-Fi 5 (11ac) +
Bluetooth 5.2
USB/SDIO/PCIe (4373E)
-40 to 85C (4373E)

54590
DB 2x2 Wi-Fi 5 (11ac) +
Bluetooth 5.1
PCIe/SDIO

54591
DB 2x2 Wi-Fi 5 (11ac), RSDB,
Bluetooth 5.1
PCIe/SDIO

54907
DB 1x1 Wi-Fi 5 (11ac) +
320-MHz R4

Wi-Fi 6 (802.11ax)

55571
TB 1x1 Wi-Fi 6 (11ax) + Bluetooth 5.2
PCIe/SDIO (Sampling)

55572
DB 2x2 Wi-Fi 6 (11ax) + Bluetooth 5.2
PCIe/SDIO (Sampling)

55573
TB 2x2 Wi-Fi 6 (11ax) + Bluetooth 5.2
PCIe/SDIO (Sampling)

Wi-Fi + Bluetooth® Combos
Infineon's AIROC™ Wi-Fi & combos for **Linux, Android**
and **RTOS**

ModusToolbox™ Software and Tools provides code
examples, tools and development support **for easier
development and reduced time to market**

Wi-Fi Connectivity Processor
High-performance and flexibility when connectivity
must standalone

On-chip MCUs, memory, and networking protocols
reduce risk and ease integration for cloud-connected
applications

Wi-Fi + Bluetooth® Combo Device Spec and optional features

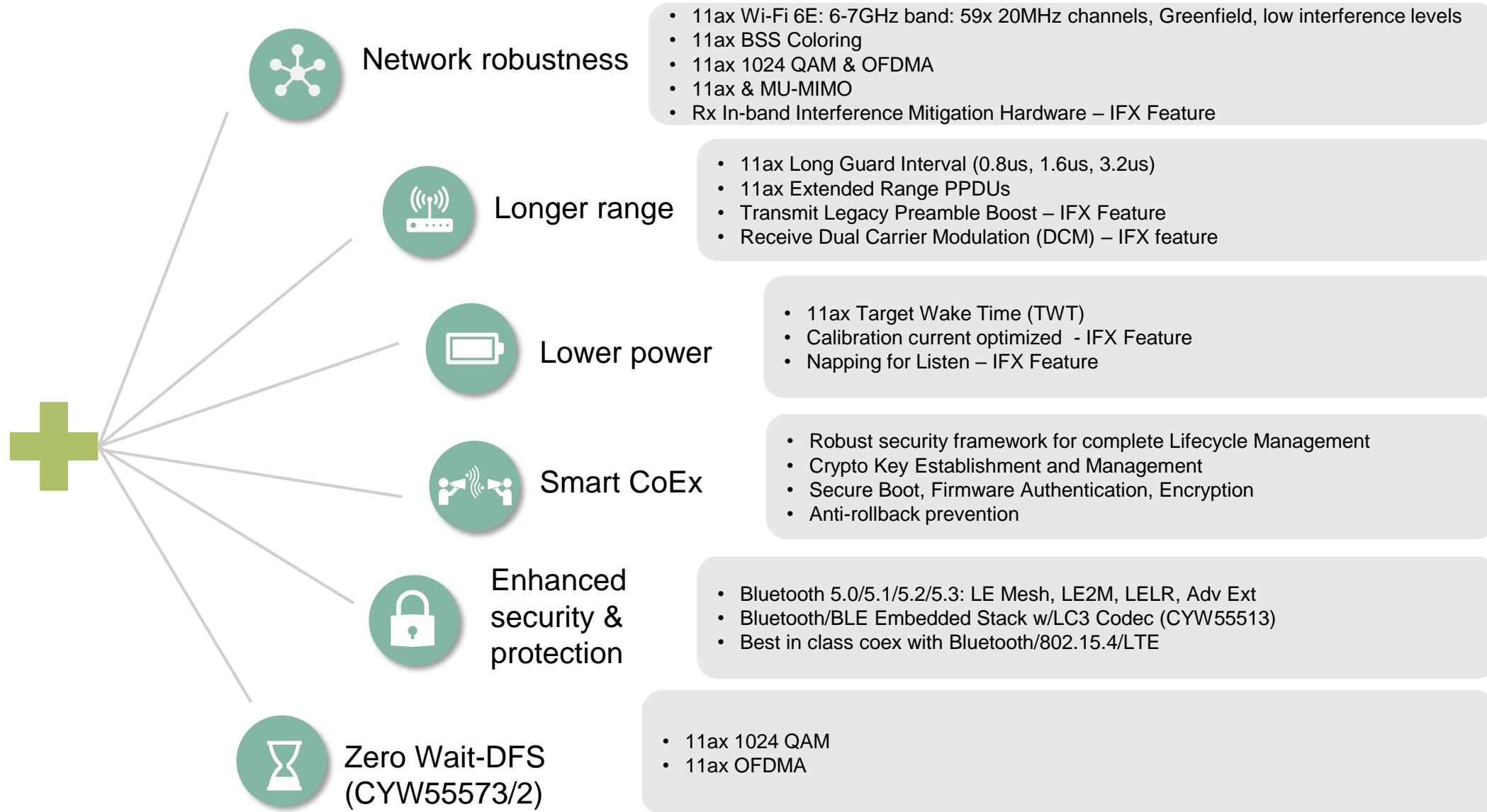| Device Type/Features	Wi-Fi + Bluetooth® Combo Devices				
Device	CYW43439	CYW430x2	CYW4373/E	CYW5459x	CYW5557x
Wi-Fi Version	Wi-Fi 4 (11n)	Wi-Fi 4 (11n) / Wi-Fi 5 (11ac)	Wi-Fi 5 (11ac)	Wi-Fi 5 (11ac)	Wi-Fi 6 (11ax)
Bluetooth® Version	5.2	5.2/3	5.2	5.1	5.3
Band	Single Band 2.4 GHz	Dual Band 2.4 GHz, 5 GHz	Dual Band 2.4 GHz + 5 GHz	Dual Band 2.4 GHz, 5 GHz	Triple Band 2.4 + 5 + 6 GHz
Streams	1x1	1x1	1x1 w/Ant Diversity	2x2	2x2
Wi-Fi Host Interface	SDIO – shared, SPI	SDIO	SDIO, SPI, PCIe (4373E), USB (shared)	PCIe, SDIO	PCIe, SDIO
Bluetooth® Host Interface	UART, SPI - shared	UART	UART, USB (shared)	UART	UART
ePA/eLNA	**X**	√	√	**X**	**X**
WPA3	√	√	√	√	√
Operating Temperature	-30C to +70C	-20C to +70C	-40C to 85C (4373E)	-40C to 85C	-40C to 85C

› Broad family of products covering all bands / Wi-Fi 4, 5, up to 6E

› Rock solid connectivity – best of breed RF performance over 20+ years

› Easy Development – Modules available from multiple vendors

› Built on Innovation – Ultra-Low power, Coexistence, new use cases

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Wi-Fi + Bluetooth® Combo Device Bluetooth Spec and optional features

Device Type/Features	CYW43439	CYW430x2	CYW4373	CYW5459x	CYW5557X
Bluetooth Version	BT5.2	BT5.2/3	BT5.2	BT5.1	BT5.3
BLE-only/Dual Mode	DM	DM	DM	DM	DM
	BR/EDR/BLE	BR/EDR/BLE	BR/EDR/BLE	BR/EDR/BLE	BR/EDR/BLE
Data Length Extension	√	√	√	√	√
Privacy 1.2	√	√	√	√	√
Secure Connections	√	√	√	√	√
2-Mbps PHY	✗	√	✗	√	√
LE Long Range	✗	✗	✗	√	√
LE Advt. Extension	✗	✗	✗	√	√
LE Audio	✗	✗	✗	✗	√
LE Power Control	✗	✗	✗	✗	√

Infineon AIROC™ benefits

Network robustness

- 11ax Wi-Fi 6E: 6-7GHz band: 59x 20MHz channels, Greenfield, low interference levels
- 11ax BSS Coloring
- 11ax 1024 QAM & OFDMA
- 11ax & MU-MIMO
- Rx In-band Interference Mitigation Hardware – IFX Feature

Longer range

- 11ax Long Guard Interval (0.8us, 1.6us, 3.2us)
- 11ax Extended Range PPDUs
- Transmit Legacy Preamble Boost – IFX Feature
- Receive Dual Carrier Modulation (DCM) – IFX feature

Lower power

- 11ax Target Wake Time (TWT)
- Calibration current optimized - IFX Feature
- Napping for Listen – IFX Feature

Smart CoEx

- Robust security framework for complete Lifecycle Management
- Crypto Key Establishment and Management
- Secure Boot, Firmware Authentication, Encryption
- Anti-rollback prevention

Enhanced security & protection

- Bluetooth 5.0/5.1/5.2/5.3: LE Mesh, LE2M, LELR, Adv Ext
- Bluetooth/BLE Embedded Stack w/LC3 Codec (CYW55513)
- Best in class coex with Bluetooth/802.15.4/LTE

Zero Wait-DFS (CYW55573/2)

- 11ax 1024 QAM
- 11ax OFDMA
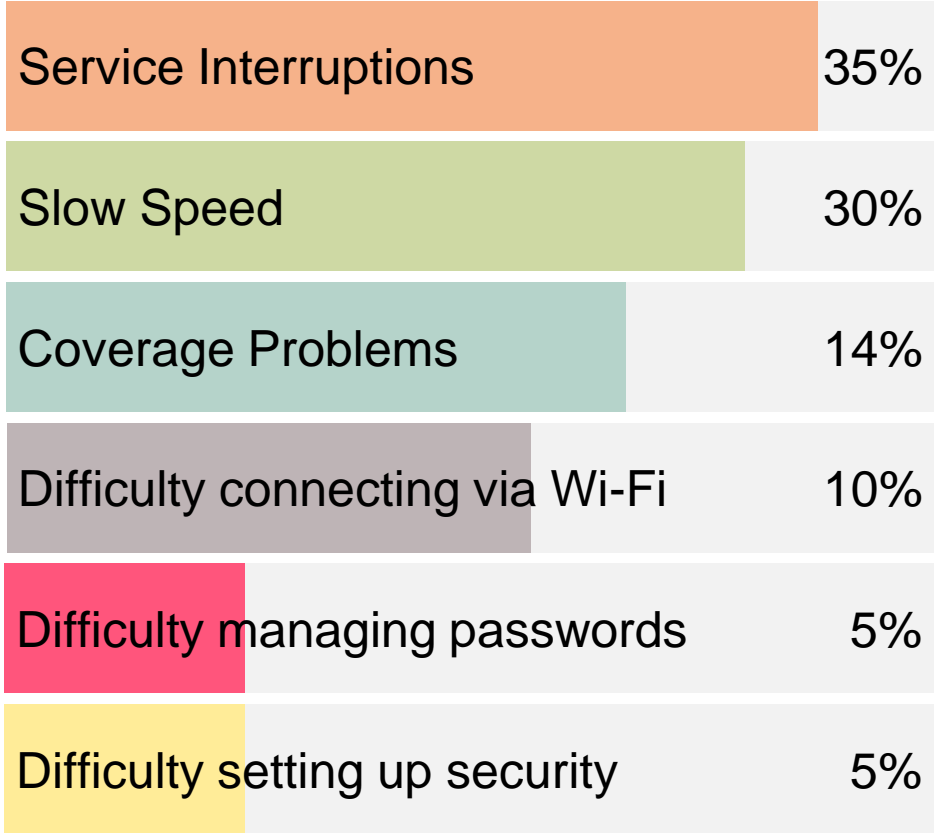
Infineon AIROC™ Wi-Fi 6/6E improves user experience

Technical Issues Experienced with Wi-Fi

US Broadband households using Wi-Fi at home

Service Interruptions	35%
Slow Speed	30%
Coverage Problems	14%
Difficulty connecting via Wi-Fi	10%
Difficulty managing passwords	5%
Difficulty setting up security	5%

CYW5557x Benefits

Powering any use case

- Robust network
- High Throughput
- Low Latency
- Extended Range
- Key management
- Multi-Layered Security

Infineon AIROC™ Wi-Fi Ecosystem partners

A global partner ecosystem enables support and development for your IoT application

Design, build and sell RF Modules with limited software and hardware certification support	Provide certified, ready-to-use modules with integrated software and custom services	Integrate modules, software and plastics into a finished product with customization options	Wi-Fi Mesh, RF expertise, Wi-Fi Driver & Bluetooth®, camera software
Module Makers	**Value-Added Resellers**	**ODMs**	**Software & Services**
muRata INNOVATOR IN ELECTRONICS	LANTRONIX®	Chicony	embed UR
USI	Laird CONNECTIVITY	FOXCONN	VIRSCIENT
AzureWave	Inventek Systems Embedding Connectivity Everywhere	PEGATRON	RHONDA Packet Path

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AIROC™ Bluetooth and BT/MCU Portfolio

32-Bit Arm Cortex M0 or Cortex-M3	32-Bit Arm Cortex-M4	32-Bit Arm Multi – Core Cortex-Mx

Legend: ■ Production ■ Sampling | Available | Future | Concept

BTBLE

20721
BT5.2/BLE CM4 SoC
1 M Flash/512 K
5 dBm Tx, Audio

20719
BT5.2/BLE CM4 SoC
1 M Flash/512 K
5 dBm Tx, Mesh

20706
BT5.2/BLE CM3 SoC
10 dBm Tx, Audio

20819 / 20820 — Now / Q122
BT5.2/BLE CM4 SoC
256 K Flash/176 K, Mesh
4 dBm/10 dBm Tx

20831 — Q423 / Q424
BT/BLE 6.0,
MCU+DSP (600 MHz),
0K Flash/1 M, Audio
13 dBm Tx, HADM

BLE+15.4

30739 — Now / Q122
96 MHz, 1 M Flash/512 K
BT 5.3, 802.15.4
Matter

BLE

20736/7
BLE 5.2 CM3 SoC
4 dBm Tx

PSoC 4 BLE
BT5.1
CM0 SoC w/ flash
3 dBm Tx

20835
BLE 5.2 CM4 SoC
384 K RAM
10 dBm Tx, Mesh

20830 — Q323 / Q324
BLE-5.3 2xCM33, HADM
512 K Flash/256 K, Mesh
Capsense, 10 dBm

20829 — Q122 / Q123
BLE-5.3 2xCM33, HADM
0 K Flash/224 K, Mesh
10 dBm

PSoC 6 BLE
BLE 5.2 CM4 & CM0+ SoC
Up to 1 M Flash/288 K
4 dBm Tx

- **Optimized for power, features and robustness**
- **Full featured BT5.3 for location and audio**
- **AoA/AoD + HADM: location based use cases**
- **Advanced Coexistence**

Bluetooth® Spec and optional features

Device Type/Features	AIROC™ Bluetooth system on chip								
LE v4.2/5.0 features	CYW20706	CYW20735	CYW20835	CYW20719/ 20721	CYW20819/2 0820	CYW30739	PSoC 6 BLE	CYW20829/20809/ 20830	CYW20831
Bluetooth Version	BT5.2	BT5.2	BT5.2	BT5.2	BT5.2	BT5.3	BT5.2	BT5.3	BT5.3
BLE-only/Dual Mode	DM BR/EDR/BLE	DM BR/BLE	BLE only	DM BR/EDR/BLE	DM BR/EDR/BLE	LE Only (& Thread/15.4)	BLE only	BLE only	DM BR/EDR/BLE
Data Length Extension	√	√	√	√	√	√	√	√	√
Privacy 1.2	√	√	√	√	√	√	√	√	√
Secure Connections	√	√	√	√	√	√	√	√	√
2-Mbps PHY	✗	√	√	√	√	√	√	√	√
LE Long Range	✗	✗	✗	✗	✗	✗	✗	√	√
LE Advt. Extension	✗	✗	✗	✗	✗	✗	✗	√	√
GATT caching	✗	✗	✗	✗	✗	✗	✗	√	√
AoA/AoD	✗	✗	✗	✗	✗	✗	✗	√	√
Isochronous Channels (LE-Audio)	✗	✗	✗	✗	✗	✗	✗	√	√
HADM	✗	✗	✗	✗	✗	✗	✗	√	√
SIG MESH	√	√	√	√	√	√	✗	√	√

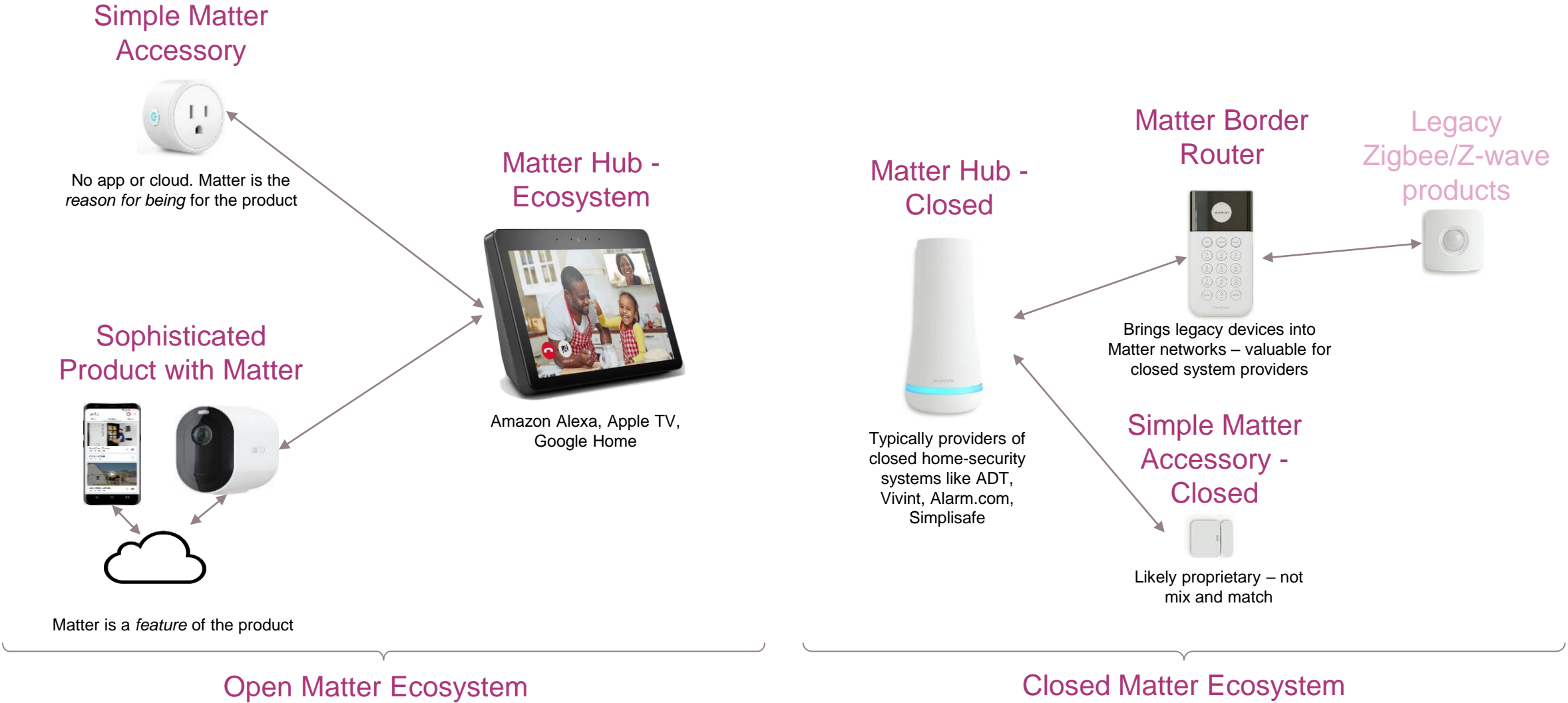|	Standard	Size	External Antenna	Extended Range	Extended Temp
PSoC6 CM4 & CM0+ SoC, 2Mbps PHY Bluetooth LE 5.2, CapSense	**CYBLE-416045-02** 1 MB Flash, 2 Mbps BLE, 36 GPIOs 14 x 18.5 x 2.00 mm SMT				
20719/20721 CM4 SoC Dual Mode BT 5.1 2 Mbps PHY	Mesh EZ-S **CYBT-413055-02** 1 MB Flash, 17 GPIOs, 12 x 16.3 x 1.70 mm SMT Mesh EZ-S **CYBT-413061-02** 1 MB Flash, 17 GPIOs Audio 12 x 16.3 x 1.70 mm SMT	Mesh EZ-S **CYBT-423054-02** 1 MB Flash, 17 GPIOs 11 x 11 x 1.70 mm SMT Mesh EZ-S **CYBT-423060-02** 1 MB Flash, 17 GPIOs Audio 11 x 11 x 1.70 mm SMT		Mesh EZ-S **CYBT-483056-02** 1 MB FlashPA/LNA (20 dBm) , 15 GPIOs, 12.75 x 18.59 x 1.8 mm SMT Mesh EZ-S **CYBT-483062-02** 1 MB Flash, PA/LNA (20 dBm) , 15 GPIOs, Audio 12.75 x 18.59 x 1.8 mm SMT	
20835 CM4 SoC, 2 Mbps PHY Bluetooth LE 5.2	Mesh **CYBT-343072-02** 512 KB SFlash, 24 GPIOs, +12 dBm TX, 13.31 x 21.89 x 1.95 mm SMT		Mesh **CYBLE-33307x-02** 512 KB SFlash, 22 GPIOs, +12 dBm TX, Ext. Antenna via RF Pad or u.FL 13.31 x 21.89 x 1.95 mm SMT		
20735 CM4 SoC Dual Mode Bluetooth 5.2	Mesh **CYBT-343052-02** 512 KB SFlash, 24 GPIOs, +10 dBm TX, 13.31 x 22.4 x 1.95 mm SMT				
20706/20707 CM3 SoC Dual Mode Bluetooth 5.2	Mesh EZ-S **CYBT-343026-01** 512 KB SFlash, 11 GPIOs. +10 dBm TX, Audio 12 x 15.5 x 1.95 mm SMT	Mesh EZ-S **CYBT-353027-02** 512 KB SFlash , 8 GPIOs, +10 dBm TX, Audio 9 x 9 x 1.75 mm SMT	Mesh EZ-S **CYBT-3330xx-02** 512 KB SFlash, LMA[3,] 11 GPIOs +10 dBm TX, Ext. Antenna via RF Pad or u.FL Audio 12 x 12 x 1.95 mm SMT		Mesh EZ-S **CYBT-343151-02** 512 KB SFlash, 11 GPIOs, +10 dBm TX, Audio 12 x 15.5 x 1.95 mm SMT
20737 CM3 SoC Bluetooth LE 5.2 Low Cost	EZ-S **CYBLE-0130xx-00** 128 KB/0KB SFlash, 16/18 GPIOs 14 x 19 x 2.25 mm SMT				
PSoC 4 CM0 SoC Bluetooth LE 5.1 CapSense	EZ-S **CYBLE-x120xx-0x** 128/256 KB Flash, 23 GPIOs 14 x 19 x 2.00 mm SMT	EZ-S **CYBLE-x220xx-0x** 128/256 KB Flash, 16 GPIOs 10 x 10 x 1.80 mm SMT EZ-S **CYBLE-x140xx-0x** PSoC 4 BLE, 128/256 KB Flash, Opamp, CMP, 4 UDBs, 25 GPIOs 11 x 11 x 1.70 mm SMT	EZ-S **CYBLE-2020xx-01** 256 KB Flash, PA/LNA (20 dBm), Ext. Antenna via RF Pad or u.FL, 19 GPIOs 15 x 23 x 2.05/1.55 mm SMT	EZ-S **CYBLE-212006-01** 256 KB Flash, PA/LNA PCB Antenna, 19 GPIOs 15 x 23 x 2.00 mm SMT	EZ-S **CYBLE-22411x-0x** 256 KB Flash, PA/LNA (+20 dBm) Opamp, CMP[6], 4 UDB[7], 25 GPIOs 9.5 x 15.4 x 1.80 mm SMT

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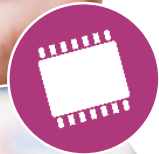
Consumers want and need to make their homes smarter

› Especially with recent trends to Work From Home and Remote Learning

› But today's Smart Home is often too complex, insecure, and incompatible

Matter will deliver

› **Smoother and easier experience**
  – For consumers (onboarding, control, monitoring, etc.)
  – For manufacturers

› **Universal interoperability**
  – Products from all matter members should work together easily

› **Strong security**
  – Pervasive & robust
  – Based on proven techniques

Matter will affect multiple end market segments

Simple Matter Accessory

No app or cloud. Matter is the *reason for being* for the product

Sophisticated Product with Matter

Matter is a *feature* of the product

Matter Hub - Ecosystem

Amazon Alexa, Apple TV, Google Home

Matter Hub - Closed

Typically providers of closed home-security systems like ADT, Vivint, Alarm.com, Simplisafe

Matter Border Router

Brings legacy devices into Matter networks – valuable for closed system providers

Legacy Zigbee/Z-wave products

Simple Matter Accessory - Closed

Likely proprietary – not mix and match

Open Matter Ecosystem

Closed Matter Ecosystem

ICW Matter roadmap

Wi-Fi MCU		802.15.4/Bluetooth® Bluetooth® LE SoC
MCU	**Wi-Fi Combo**	

Wi-Fi Combo (11n, 11ac)
Complete portfolio with low power keep alive across 11n and 11ac, offer ac friendly ultra low power series optimized for battery powered connected home solution

CYW4373/E
DB 1x1 11ac VHT80
SDIO/PCIe/SDIO
BT5.0, UART/USB
Now

CYW43012
ULP DB 1x1 11n HT20
11ac Friendly
SDIO/SPI, BT5.0
Now

CYW43439
SB 1x1 11n HT40
SDIO, BT5.0, UART/SDIO
Now

30739
BLE5.3/Thread/ Matter
CM4 SoC
1M Flash/512K, 5dBm Tx
H123

PSoC™ 64
150 MHz Cortex®-M4
/100 Mhz M0+, Security
Upto 2MB Flash/1MB RAM
H123*

PSoC™ 62
150 MHz Cortex®-M4
/100 Mhz M0+
Upto 2MB Flash/1MB RAM
Now

PSoC™ 6
MCUs for the broad-base of IoT and consumer applications, bringing best in class low power, connectivity, and security

* Under Development, Schedule subject to change

Matter stack | **MCU** | **Wi-Fi combo** | **Thread/Matter BLE combo** | **MP** | **In dev**

Infineon Proprietary