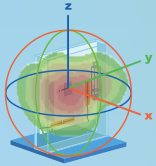# Embedded IoT Wireless Modules & Design-in Services

Simplifying Wireless Connectivity for IoT Platforms
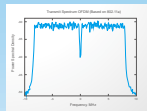
⁄ **Wi-Fi Module**

⁄ **Wi-Fi + Bluetooth Module**

⁄ **4G LTE Module**

⁄ **Cellular + GPS Module**

⁄ **Industrial Grade Module**

⁄ **Wireless Design-in Services**

WiFi · GPS · Bluetooth · NB-IoT · LoRa · Lte · 3G

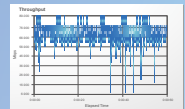**Wireless Design-in Services**

Optimal Antenna Design

RF Certification

Software Integration

System Performance Tuning

ADVANTECH

Enabling an Intelligent Planet

Simplifying embedded IoT wireless connectivity on your embedded platforms

To fully realize the benefits of connected platforms in the IoT era, Advantech Embedded IoT Wireless Module Solutions offer Bluetooth, Wi-Fi, GPS, 3G, and 4G modules with ready-to-use software and wireless design-in services as a total package for embedded vertical applications. We also apply wide temperature and coating wireless solutions for industry outdoor and rigorous application. With Advantech wireless modules, system integrators, and industrial PC vendors can easily implement extra wireless functions into their own systems or board level applications.

At a Glance

Wide-range product offerings with premium quality and longevity	Wireless module integration services for rapid application deployment	Lab documentation and programming tools for global certification	Software services for bus interface / CPU / OS differentiation

Value-added Wireless Software Package

Software AP	Wi-Fi Fast Roaming	CCX Wireless Security	IoT Connection Management

Wireless Design-in Services

Wireless Software Integration	Optimal Antenna Design	RF Certification	Wireless System Performance Tuning

Embedded IoT Wireless Modules

Short Range Series Wi-Fi, Bluetooth	High Throughput Series 4G LTE, Wi-Fi 6	Smart Mobility Series 3G/ 4G LTE CAT1, GPS	Industrial Grade Series Wi-Fi, 3G, 4G LTE, GPS, LPWAN

Short Range Series

Advantech has developed unique and robust short range wireless IOT solutions such as Wi-Fi 802.11b/g/a/n + BT 4.0/4.1/4.2 combo solutions and will migrate to BT5.0 . Compared with other legacy wireless technology the new BT5.0 is more suitable for low power short range but higher throughput related indoor applications.

Applications

Automated Guided Vehicle (AGV)	Ultra Sound Device	Medical Tablet PC	Wireless Gateway	Point of Sale (POS) System	Scanner & Printer

Wi-Fi Modules

From single band to dual band with standard Mini-PCIe or M.2 2230 form factor PCI-e bus or USB 2.0 bus interface ; support Wi-Fi 802.11 b/g/a/n/ac stable and high quality RF certification ready module solutions.

WIFI + B/T Combo Modules

From single band to dual band with standard Mini-PCIe or M.2 2230 form factor PCI-e /SDIO 3.0/ USB 2.0 bus interface; support Wi-Fi 802.11 b/g/a/n/ac+Bluetooth 4.2 exchanges data from fixed and mobile devices, creating Personal Area Networks (PAN) with high levels of security and RF certification ready module solutions.

Product Highlights
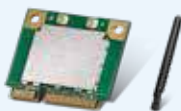
EWM-W157
- WiFi 802.11a/b/g/n/ac 1*1+BT 4.0
- Mini PCI-e HMC type
- Worldwide Certified

EWM-W163
- EWM-W163
- WiFi 802.11b/g/n/ac 2*2+BT 4.2
- M.2 2230 type
- Worldwide Certified

High Throughput Series

Advantech's wireless IoT incorporates industry-leading RF specification and features such as 802.11 ac wave2, MU-MIMO, 802.11AX, and LTE CAT4/CAT6 /CAT9, to empower the newest wireless high data throughput solutions. Users can access their web and cloud application information through our high performance wireless solution to make sure their system will keep operating at its optimum performance.

Applications

| Digital Signage | Video Display Application | Gaming Machine | Wireless Gateway | Transportation | Video Surveillance |

Cellular Modules: 4G LTE CAT4/6/9

Industry-leading RF specification and features such as Mini-PCIe and M.2 3042 B LTE CAT4/CAT6 /CAT9, to empower the newest wireless high-data throughput solutions for high-definition video streaming, high-quality online gaming, public safety (like IP surveillance), cloud computing and so on.

Wi-Fi 6 Modules

Wi-Fi 6, based on the IEEE 802.11ax standard, enables next generation Wi-Fi connectivity providing the enhanced performance to users in demanding environments, from IoT and smart city, to businesses running large-scale, mission critical deployments and uses in retail settings, stadiums, transportation hubs, including a growing array of location-based applications and services and bandwidth intensive applications

Product Highlights

EWM-C117
- LTE CAT4/HSPA+/GPRS
- Mini PCI-e FMC type
- FCC, GCF, IC, PTCRB, R & TTE Certified

EWM-C163
- LTE CAT6
- M.2 3042 type
- FCC/CF/GCF Certified

Find Out Your Ideal Wireless Module!

Smart Mobility Series

Advantech 3G/4G connection management provides auto connection when systems integrated 3G/4G function at their real field application. That did help customer to save the engineer resource to solve some unknown wireless disconnection related issues. The connection management tool implements a cost-effective and short product development cycle, ensuring that effective and stable auto dialing function.

Applications

Transportation

Mobility Tracker

Environment Monitor System

Remote Devices Control System

Cellular Modules: 3G/4G LTE CAT1

For mobility application and transportation; RF specification and features such as 3G+GPS solutions are suitable to fulfill the outdoor position and tracking requirement. The LTE CAT1+GPS will be the right solution for some area will stop their local 3G service in the future.

GPS Modules

Advantech provides diverse GPS module types including A-GPS, GLOSNASS, Beidou, QZSS, and Galileo for a variety of applications. The standard mini PCI-e form factor and USB 2.0 bus interface is easy to be integrated to most industry PC platforms.

Product Highlights

EWM-G109
- NEO-M8N multi-GNSS
- Mini PCI-e HMC type
- CE Certified

EWM-C128
- LTE CAT1/HSPA+/GPS
- Mini PCI-e FMC type
- NCC(Taiwan), RCM(Australia) Certified

Industrial-Grade Series

In order to make sure wireless system connection quality under wide temperature working environment ; wireless module solution should upgrade to industrial grade (-40°C~ 85°C) by changing some RF key components to make sure the RF signal quality and performance. And, adding conformal coating on PCBA except contact parts then Assemble shielding cover on PCBA to achieve waterproof and dustproof to guarantee the wireless solution reliability.

Applications

Military Usage Devices	Traffic Monitor Devise	Outdoor Wireless Gateway	Auto Driving Application	Monitor System in Harsh Environment

Wide Temperature Modules

We have a full range of different form factor wide temperature wireless module solutions such as Mini-PCIe and M.2 Wi-Fi/3G/GPS/4G LTE module solutions, to empower the industry and military grade applications.

85°C

- 40°C

Throughput (Mbps)

160
140
120
100
80
60
40
20
0

-40 -30 -20 -10 0 10 20 30 40 50 60 70 80 Temperature (℃)

◆ Modules for wide temperatures use

■ Modules for non-extreme temperatures use
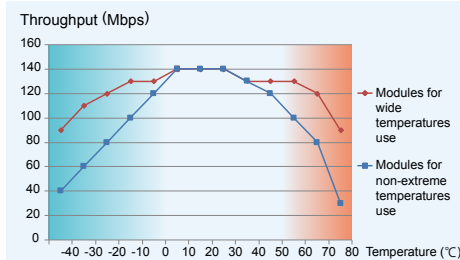
- The wireless throughput performance will drop dramatically at wide temperature environment if applying modules for non-extreme temperatures use.

- The Wide Temperature Module keeps the throughput performance more reliable and stable in harsh environment.

Coating Modules

For industry and military grade applications, conformal coatings protect wireless module components from exposure to moisture, salt, chemicals, and temperature changes, which helps prevent boards from corroding.

Product Highlights
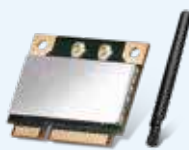
EWM-W190

- WiFi 802.11a/b/g/n/ac 2*2+BT4.2
- Mini PCI-e HMC type
- CE/FCC Certified

EWM-NB147

- LTE Cat M1 / NB1 engine
- Mini PCI-e FMC type
- FCC, ISED, GCF, NCC, PTCRB, RCM, AT&T, Telstra, T-Mobile, Verizon Certified

Wireless Design-in Services

To help customers quickly develop intelligent platforms with wireless functions, Advantech offers streamlined wireless design-in services including wireless module design package with RF certification, optimal antenna and module configuration, wireless system performance verification, and an online document center. All provided by Advantech's expert team to help customers create an efficient development environment.

Optimal Antenna Design → **RF Certification** → **Wireless Software Integration** → **Wireless System Performance Tuning**

① Optimal Antenna Design

To fulfill antenna design requirements, Advantech provides different types of antennas to configure with various modules selected by customers. Here's how Advantech can help:

Select an antenna based on different module FCC reports

The FCC report discloses various types and features of antenna. If the customer wants to use a module from the original RF report, the most important thing is to compare the antenna peak gain and then select a suitable high efficiency antenna.

Optimizing antenna performance through RF tuning

Some customers order antennas from an on-line market directly for their system, but the problem is it can be hard to get the optimal antenna performance. The performance of an antenna can be influenced by the system metal part and the antenna placement inside the case.

Antenna Selection

Communication Protocol	Antenna Type
GPS	active antenna /passive antenna
Wi-Fi & Bluetooth	external Dipole antenna/ system inside PIFA antenna/chip antenna
LTE	multi band wide band antenna

Case Study on mPOS Wireless Performance Tuning

Challenge: Antennas are one of the most important factors in the overall performance of wireless, but not every company has the domain knowledge to choose an optimal antenna solution for their specific wireless application. A suitable antenna should consider the operating frequency band, the peak gain, and efficiency, and we have to consider the antenna location versus EMI coverage and isolation.

Solution: After redesigning, the new antenna performance was much greater than the original design and had an improved efficiency of 10~30%, and isolation values of better than 20dB.

Radiated efficiency (%)

Enhanced 30% antenna efficiency of 5GHz band

Enhanced 10% antenna efficiency of 2.4GHz band

70 60 50 40 30 20 10 0

2400 2437 2450 2484 2500 5150 5250 5350 5470 5600 5725 5850   Freq. (MHz)

—— Proposed Antenna   —— Original Antenna

Efficiency Test of a 7" System
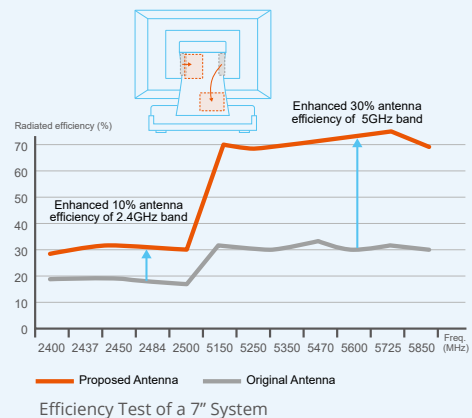
2 RF Certification Design Package

Wireless solutions are diversified and require different RF tools based on multi-IC solutions. Advantech offers a complete RF certification design package including RF testing tools, certification reports, and testing tool application notes. Advantech's professional RF engineer teams are able to verify and fine tune RF certification specifications for customers our own shielding room and RF spectrum analyzer equipment. This helps customers quickly get regulation certification for different RF technologies such as CE, FCC, PTCRB and more. Every electronic product needs to pass specific RF certifications when shipping to different countries. The RF test cost is huge and the test procedures are quite long for most customers. The test package contains the test software and tool configurations for different IC. The application notes save test setup and lab times.

**Advantech Shielding Box &
RF Spectrum Analyzer**

CE FC GCF (Global Certification Forum) **PTCRB** *PCS Type Certification Review Board*

3 Wireless Software Integration

For embedded systems there are many different SCO/CPU types with PCI-E/USB/SDIO/UART multi bus interface for different wireless solutions running different OS. Some solutions offer open source software and some IC solutions offer proprietary software. Some solutions need RF lab related software support but Advantech wireless solution service provides clear driver related information and support, helping embedded system integrators to quickly add wireless functionality.

Software AP   Wi-Fi Fast Roaming   CCX Wireless Security   IoT Connection Management

7

④ Wireless System Optimization

Unlike wire-connected communications, wireless signals decay rapidly during propagation. Once receiving signal strength is below the threshold power index that the IC transceiver can successfully demodulate, users will notice a signal drop as a result. So Advantech offers streamlined services for wireless system optimization. Advantech's technical team provides design services to make sure wireless communications are totally reliable. This means that communication links between transmitters and receivers are sustainable and dependable.

Multiple Standard Wireless Protocol Support

Advantech wireless module solutions provide multi-standard wireless protocol modules for customer selection. Different standards define their own transmission power (Tx) and receiving signal (Rx) sensitivity levels. As a result, each standard affects the transmission distance and signal capability, as well as interference from other wireless systems, so for different application scenarios, we will help customers select a suitable wireless platform with the right modulation, Tx, and Rx protocols that match their application. Advantech also provides a private connection service (proprietary protocol) for enhancing communication security.

Frequency Band Selection

Wireless Propagation Considerations

Regarding protocol selection, operating frequency bands is also an important index. Wireless signals carried by higher frequency microwaves decay faster than signals carried by lower frequency microwave during propagation. For example, 5 GHz WiFi signals decay faster than 2.4 GHz WiFi signals which means that 2.4 GHz signal can propagate longer than 5 GHz signal with same transmission power.

Environment Considerations

Although 2.4 GHz signals can propagate longer than 5 GHz signals, the 2.4 GHz ISM band is too crowded with all the wireless devices in operation. Advantech's technical team helps customers consider their application environment, and gives advice before offering a suitable total solution.

Certification Considerations

Advantech provides ready certified modules, antennas, and M2M solutions based on regional regulations and rules.

Wireless System Performance Verification

There are many factors limiting Wi-Fi connection speeds. For instance, Wi-Fi performance can be influenced by network protocol overheads, radio interference, physical obstructions on the line of sight between devices, and the distance between devices. As more devices communicate on the network simultaneously, its performance will decrease. Good wireless performance is based on good RF signal quality, suitable antenna gain and efficiency, and good system compatibility between CPU performance and platform power management. We also need to consider normal operation and critical environment modes. Advantech wireless module team ensures a professional wireless system performance verification service as follows:

RF performance check and tuning

Verifies TX power range/EVM/mask; RX signal sensitivity level using professional RF equipment and engineering methods.

System throughput check and tuning

Uses the Chariot standard TCP/IP base test tool recognized by labs. Shows overall system wireless throughput and also requires RF engineers to perform data analysis and judgements for different vertical applications.

Compatibility check and tuning

Some wireless performance issues are caused by system power management settings and specific bus interface compatibility issues that will need specific settings dependent upon the various hardware and software configurations.
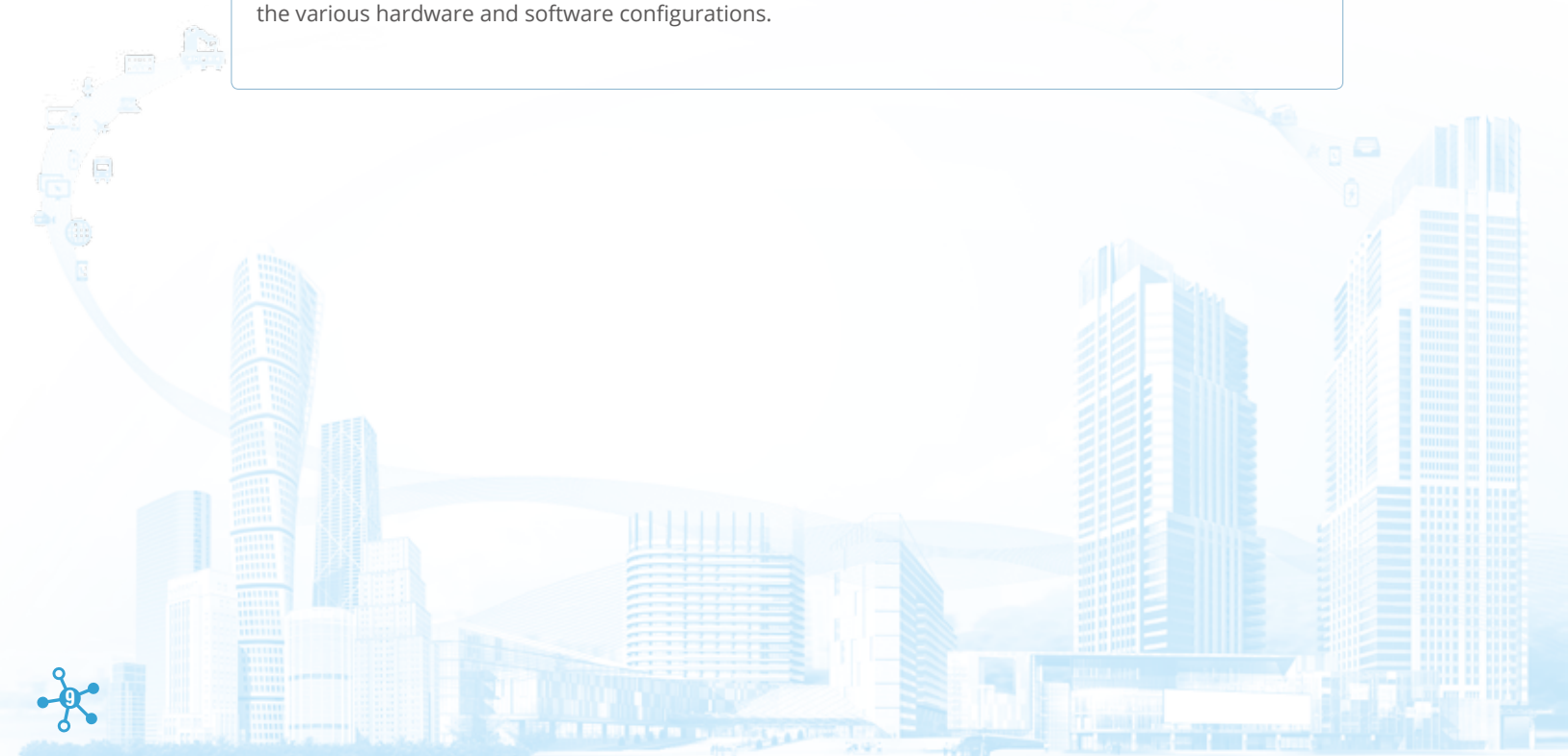
Value-added Wireless Software Package
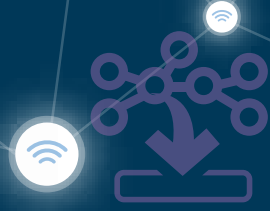
To help customers develop intelligent wireless platforms for different vertical applications, wireless software must be developed, but not all IoT system integrator or platform providers have this kind of resource. Advantech wireless module team is able to provide a software APP for wireless server/router, with fast roaming for mobile machines in smart factory applications. Advantech's value-added wireless software package includes:

3G/4G LTE Connection Management Tool

Advantech's 3G/4G connection management feature provides automatic connection when integrating 3G/4G functionality into field applications. Doing so helps customers save on engineering resources trying to solve unknown wireless disconnection issues. The connection management tool shortens development cycles and ensures efficient and stable auto dialing.

Wireless Fast Roaming

Wireless fast roaming allows a client device to roam quickly in environments with WPA2 Enterprise security. This ensures the client device does not need to re-authenticate to the RADIUS server every time it roams from one access point to another. This function is very typical but not easy to optimize for different application environments. Advantech applies not only the basic roaming setting but also the optimal settings for a range of different environments.

Software Driver Tunning Setting:

implement the 802.11r SW, which is the IEEE standard for fast roaming, where the initial handshake with the new AP is done even before the client roams to the target AP, which is called Fast Transition (FT). The initial handshake allows the client and APs to do the Pairwise Transient Key (PTK) calculation in advance. This is useful for client devices that have delay-sensitive applications.

Platform Power Management Setting :

Check if platforms with smaller batteries like mobile devices require a lot of power management or the same as larger and power hungry devices likes desktop computers. Modify suitable APM/ACPI related system power management setting for different application requirement.
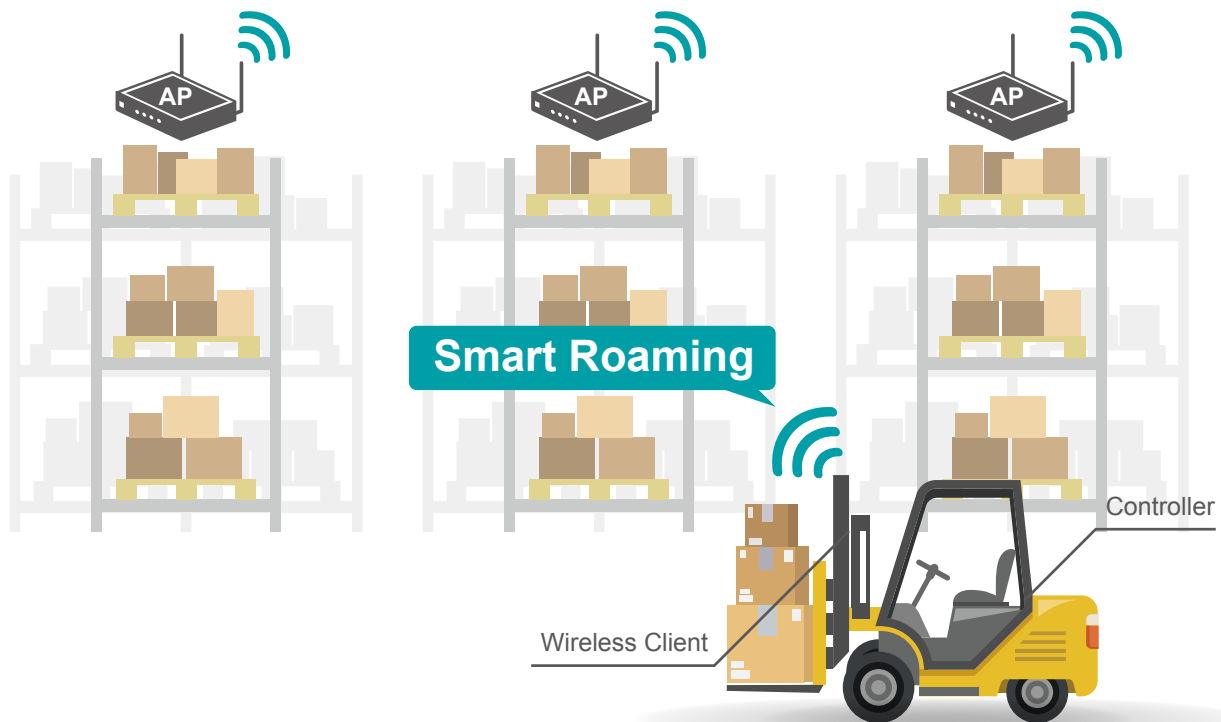
Software AP

Using a hotspot to enable other WLAN devices to access the WAN to Internet is a form of bridging known as "tethering." Manufacturers and firmware creators can enable this functionality on many Wi-Fi devices, depending upon the capabilities of the hardware, and most operating systems, including Android, Windows and Linux include features to support this. Advantech's embedded IoT Wi-Fi solution offers this function for many different hardware/software configurations.

Cloud

LAN Port

3G/4G

Wi-Fi

Carrier Cell Tower

Platforms with Embedded IoT Wireless Module
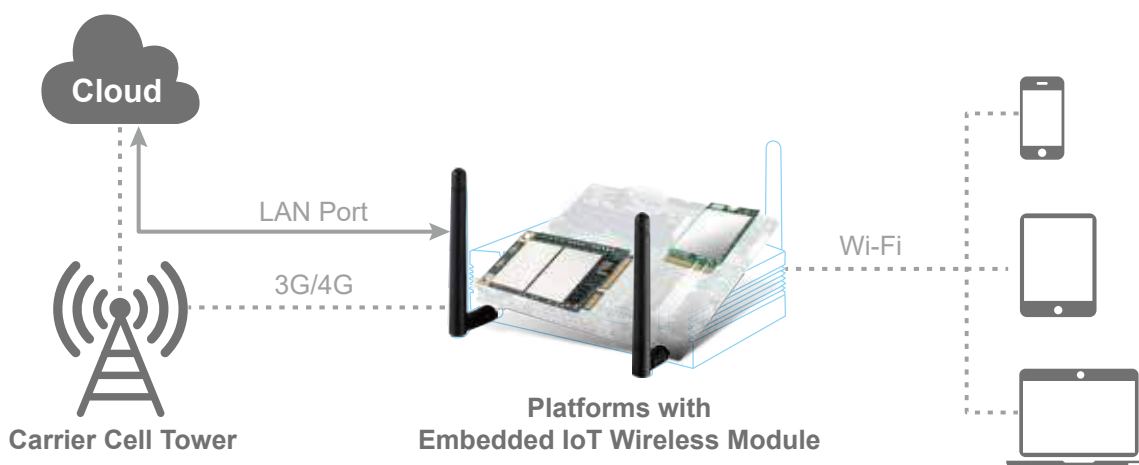
On-line Document Center

To help customers access resources quickly, Advantech Embedded IoT Wireless Modules have created an "online document center" to store all product datasheets, module reports, drivers and other information. Please visit wireless-module.advantech.com

Embedded IoT Wireless Modules On-line Document Center Resources

Scan to Visit Website

Document Type	Content
Datasheet	Module RF spec/ features / operating temperature/ support OS
Report	Module RF certification report / RoHs data
Design Guideline	Detail pin function description, module power on sequence ,I/O reference schematics, detail TX/RX spec
Drivers	Multi-OS drivers (depending on IC)

Worldwide Certified Wi-Fi/ Bluetooth Combo Solutions for Ultrasound Application

The new generation ultrasound platforms need advanced signal transmission and reception processors providing highly sensitive and accurate echo detection. Innovative transducer technologies allow better penetration, higher resolution, greatly enhancing users' diagnostic experience

Requirements & Solutions

A China medical devices solution company needs reliable and high quality wireless solution for medical electronics platform. They also require full RF certification supporting difference countries.

Advantech wireless solution can work with the original platform OS. We also apply the hardware + software system design-in technical service that can meet customers' RF performance/ throughput/ system compatible reliability requirements. EWM-W163M201E is a highly integrated wireless local area network (WLAN) solution to let users enjoy the digital content through the latest wireless technology without using the extra design cost and effort. It combines with Bluetooth 4.1 and provides a complete 2.4GHz Bluetooth system which is fully compliant with Bluetooth 4.1 and v2.1 that supports EDR of 2Mbps and 3Mbps for data and audio communications. It enables a high performance, cost effective, low power, compact solution that easily fits onto the PCI Express and USB M.2 interface for customers.

Benefits

- Worldwide RF certification
- 5 years product longevity
- New standard M.2 2230 form factor
- 2.4G/5G dual band

Wide Temperature Mobile Wireless Solutions for City Bike Service Station Application

Public demand for City Bike services has been increasing; especially near new MRT and major bus stations around the city. Wireless communication was needed between City Bike service stations and the control center. Adapting mobile infrastructure — with diverse and flexible wireless communication — for different locations was the priority in this case.

Requirements & Solutions

One MRT company in Taiwan needed to apply a 4G connection function at its City Bike service stations. This application required 4G LTE wireless functionality for communication. The stations were, by nature of their locations, subject to constant vibration, occasional shocks, and a wide range of temperatures. The wireless solution needed to operate effectively under harsh environmental conditions. The City Bike service stations required an auto re-connect function in the event of wireless field applications disconnecting.

 Advantech provided an embedded fanless box PC ARK-2230 integrated with the LTE module EWM-C117FL which supported a wide temperature range of -40 to +85 °C. The solution supported 4G/LTE Bands Cat. 4 (Max DL 150Mbps) and the industry standard Mini PCIe package enabled easy integration onto an application board and was ideal for small series manufacturing. The EWM-C117FL modules were manufactured in ISO/TS 16949 certified sites, with the highest production standards for quality and reliability. Each module was fully tested and inspected during production. Advantech provided a 4G connection management utility to support the 4G auto connection requirement.

Benefits

- Wide temperature: -40 to +85 °C
- Five year product longevity
- Standard mini PCIe form factor
- Advantech 4G connection management

Wireless Solutions for Smart Factory Application

For smart warehouse applications, AGVs used in warehouses and distribution centers move loads around the warehouses and prepare them for shipping, loading, receiving, and moving from the induction conveyor to logical storage locations within the warehouseat the site.

Requirements & Solutions

An online business needed to implement wireless AGV at their warehouse location. Wireless roaming performance needed had to support real time control as a key function for of the system. The businessy required a stable and reliable WiFi roaming solution.

Advantech provided a RISC platform EBC-RB02 +EWM-W135H01E 802.11 a/b/g/n 2T2R WiFi solution. This solution offered a much better experience for high-bandwidth applications — enabling systems to handle demanding applications like WiFi roaming. It offered higher capacity, improved power management, and lower latency to readily handle demanding wireless applications — paving the way for new AGV applications at smart warehouse and in enterprise networks. In addition, professional system + wireless + antenna technical support saved on time and costs during the project's development.

Benefits

- 802.11 a/b/g/n 2T2R high speed dual band wireless solution
- X86/ARM+Windows/Android configuration.
- Standard mini PCIe form factor

Embedded Platform Wireless Solution for Smart Lighting Application

Intelligent street lighting is an important part of the energy conservation mix in smart cities. With digital networks and embedded sensors, intelligent street lights can collect and transmit data that help cities monitor and respond to any environmental circumstances, from traffic congestion to parking availability and air quality.

Requirements & Solutions

A lighting company in US wanted to develop smart street lighting solutions by installing sensors and digital tools into their existing product lines. They also need to apply remote management through wireless technology. For wireless module integration, the main challenges are the working temperature range, wireless software security integration and specific antenna and RF certification. Advantech provided Wi-Fi, Bluetooth EWM-W162M plus support for -30~85°C wide temperature operation for wireless connectivity.

EWM-W162M is 802.11 ac/a/b/g/n + Bluetooth 4.2 M.2 2230 (E-Key) Card. We worked with customer for the specific antenna+ RF certification while our IoT wireless solution can apply the necessary wireless security at customer's platform ; support the WPA/WPA2 and WEP 64-bit and 128-bit encryptionThe EWM-W162M also supports the IEEE 802.11i security standard through the implementation of Advanced Encryption Standard (AES)/Counter Mode CBC-MAC Protocol (CCMP), Wired Equivalent Privacy (WEP) with Temporal Key Integrity Protocol (TKIP), Advanced Encryption Standard (AES)/Cipher-Based Message Authentication Code (CMAC). These security features are necessary for smart city application.

Benefits

- Wide temperature -30 to 85 °C
- 5 years product longevity
- Linux driver integration software service

LPWAN

Model Name	EWM-NB147	EWM-NB157
Part Number	EWM-NB147F01E	EWM-NB157S01E
Form Factor	Full Size Mini PCI-e	LGA stamp type
SIM slot	With SIM card slot	No SIM card slot
Radio Technology	LTE Cat M1 / NB1	3GPP Rel.14 NB-IoT
Downlink/ Uplink	DL 375 kb/s Cat M1 Half-duplex UL 375 kb/s Cat M1 Half-duplex	-
Frequency Band	4G/LTE Cat. 1: Bands 2, 3, 4, 5, 8, 12, 13, 20, 28	Support Band 1,3,5,8
Main Chipset	u-blox SARA-R410-02B engine	Hi2115
Operating Temperature	(-40 ~ +85 °C) (Operating)	(-40 ~ +85 °C) (Operating)
Signal protocol	USB 2.0	UART
support area	FCC, ISED, GCF, NCC, PTCRB, RCM, AT&T, Telstra, T-Mobile, Verizon	FCC

3G

Model Name	EWM-C109		EWM-C118
Part Number	EWM-C109F603E	EWM-C109F6G3E	EWM-C118HD01E
Form Factor	Full Size Mini PCI-e	Full Size Mini PCI-e	Half Size Mini PCI-e
Radio Technology	HSPA	HSPA	HSPA
Downlink/ Uplink	7.2 Mbps/ 5.76 Mbps	7.2 Mbps/ 5.76 Mbps	7.2 Mbps/ 5.76 Mbps
Frequency Band	6-band UMTS/HSPA network, 800/850/900/1700/1900/2100 MHz	6-band UMTS/HSPA network, 800/850/900/1700/1900/2100 MHz	2-band UMTS/HSPA network, 900/2100 MHz
Main Chipset	u-blox LISA-U200	u-blox LISA-U200 and MAX-6	u-blox SARA-U270
Operating Temperature	-40 to +85 °C	-40 to +85 °C	-40 to +85 °C
SIM slot	With SIM card slot	With SIM card slot	With SIM card slot
GPS RF Receiver Type	-	50-channel, GPS L1 C/A code, SBAS: WAAS, EGNOS, MSAS	-
GPS Acquisition	-	Cold starts: 26s/ Aided starts: 1s/ Hot starts: 1s	-
GPS Accuracy	-	Position 2.5m / SBAS 2.0m	-
GPS Sensitivity	-	Tracking: -162 dBm/ Cold starts: -148 dBm / Hot starts: -157 dBm	-
GPS Type	-	Hardware standalone	-

GPS

Model Name	EWM-G108	EWM-G109	EWM-G110
Part Number	EWM-G108H01E	EWM-G109H01E	EWM-G110H01E
Form Factor	Half Size Mini PCI-e	Half Size Mini PCI-e	Half Size Mini PCI-e
GPS Type	Hardware standalone	Hardware standalone	Hardware standalone
Signal Protocol	USB	USB	USB
Chipset	NEO-7	NEO-M8N	NEO-M8U+3D inertial sensors
Operating Temperature	-40 to +85 °C	-40 to +85 °C	-40 to +85° C
RF Receiver Type	56-channel, GPS L1 C/A, GLONASS L1 FDMA, QZSS L1 C/A, Galileo E1B/C, Compass ready SBAS: WAAS, EGNOS, MSAS	GPS module, multi-GNSS (GPS, Beidou, GLONASS, Galileo, QZSS and SBAS)	GPS module, multi-GNSS (GPS, Beidou, GLONASS, Galileo, QZSS and SBAS)
GPS Acquisition	Cold starts: 29s / Aided starts: 5s / Reaquisition: 1s	Cold starts: 26s / Aided starts: 2	Cold starts: 26s / Aided starts: 2
GPS Accuracy	Position 2.5m / SBAS 2.0m	Aided starts: 2	Aided starts: 2
GPS Sensitivity	Tracking: -162 dBm / Cold starts: -148 dBm / Reacquisition: -148 dBm	Tracking: -167 dBm / Cold starts: -148 dBm / Reacquisition: -160 dBm	Tracking: -167 dBm / Cold starts: -148 dBm / Reacquisition: -160 dBm

Note: "-" : means Not Applicable (N/A)

4G LTE CAT1/CAT4/CAT6

Model Name	EWM-C128		EWM-C117	
Part Number	EWM-C128F01E	EWM-C128FG01E	EWM-C117FL03E	EWM-C117FL04E
Form Factor	Full-size Mini PCIe	Full-size Mini PCIe	Full-size Mini PCIe	Full-size Mini PCIe
SIM Slot	With SIM card slot	With SIM card slot	With SIM card slot	With SIM card slot
Radio Technology	LTE CAT1	LTE CAT1+GPS	LTE CAT4	LTE CAT4
Downlink/ Uplink	DL:10 Mbps, UL:5 Mbps	DL:10 Mbps, UL:5 Mbps	FDD LTE Max150Mbps(DL) / 50Mbps(UL)	FDD LTEMax150Mbps(DL) / 50Mbps(UL)
Frequency Band	4G/LTE Cat. 1: Bands 3, 8, 28 for Taiwan 3G UMTS: band 1	4G/LTE Cat. 1: Bands 3, 8, 28 for Taiwan 3G UMTS: band 1	4G LTE bands 2 / 4 / 5 / 7 / 17, 3G bands 1/2/4/5/8, GPRS band 850 / 900 / 1800 / 1900	4G LTE bands 1 / 3 / 5 / 7 / 8 / 20, 3G bands 1/2/5/8, GPRS: 850/ 900/1800/1900MHz
Main Chipset	u-blox LARA-R280	u-blox LARA-R280+M8M-0 GNSS engine	u-blox TOBY-L200	u-blox TOBY-L210
Operating Temperature	(-40~+85) (Operating)	(-40~+85) (Operating)	-40 ~ +85 °C (Operating)	-40 ~ +85 °C (Operating)
Signal Protocol	USB 2.0	USB 2.0	USB 2.0	USB 2.0
Support Area	Taiwan/Australia	Taiwan/Australia	US	EU/APAC

Model Name	EWM-C141	EWM-C160	EWM-C163	EWM-C145
Part Number	EWM-C141M201E	EWM-C160M201E	EWM-C163M201E	EWM-C145FL01E
Form Factor	M.2 3042 (B key)	M.2 3042 (B key)	M.2 3042 (B key)	Full Size Mini PCI-e
SIM Slot	No SIM card slot	No SIM card slot	No SIM card slot	With SIM card slot
Radio Technology	LTE CAT4	LTE CAT6	LTE CAT6	LTE CAT4+GPS
Downlink/ Uplink	FDD LTE Max150Mbps(DL) / 50Mbps(UL)	FDD LTE Max 300Mbps(DL) / 50Mbps(UL) TDD LTE 112Mbps(DL) / 10Mbps(UL	FDD LTEMax300Mbps(DL) / 50Mbps(UL)	FDD LTEMax150Mbps(DL) / 50Mbps(UL) TDD-LTE: 132 Mbps DL, 30 Mbps UL
Frequency Band	4G LTE FDD: 1, 3, 5, 7, 8, 20, 28, 3G bands: 1, 5, 8,GPRS: 850(B5), 900(B8), 1800(B3), 1900(B2)	LTE FDD: 1, 3, 8 /TDD: 38, 39, 40, 41 3G bands: 1, 8	4G LTE FDD: Band 1, 3, 7, 8, 20, 28, 32 3G bands: 1, 8	FDD-LTE: B1/B3/B5/B8 TDD-LTE: B38/B39/B40/B41 HSPA/UMTS: 900/850/2100MHz GSM/GPRS/EDGE TD-SCDMA: B34/B39 EVDO/CDMA: BC0
Main Chipset	Intel 7120M	Intel 7262	Intel 7262	Qualcomm MDM9X07
Operating Temperature	-20 ~ +70 °C (Operating)	-10 ~ +55 °C (Operating)	-30 ~ +65 °C (Operating)	(-40~+85) (Operating)
Signal Protocol	USB 2.0	USB 2.0	USB 2.0	USB 2.0
Support Area	EMEA	China	EMEA	China

Optional Antenna Selection

Part Number	1750008717-01	1750008772-01
Size (cm)	10.9 x 1.0	15 x 1.0
Support Frequency	WiFi Dual band antenna (2.4Ghz and 5Ghz)	WiFi Dual band antenna (2.4Ghz and 5Ghz)
Antenna Gain	2.89 dBi @ 2.4-2.5GHZ, 3.58dBi @ 5.15-5.85GHz	2.93 dBi @ 2.4-2.5GHZ, 4.4dBi @ 5.15-5.85GHz
Polarization	Linear	Linear
Connector	RP-SMA male	RP-SMA male
Impedance	50 ohm	50 ohm

Optional Accessories

Part Number	1750008767-01
Length (cm)	150
Cable Type	WiFi cable
Cable Loss	0.62dB@2500MHz for 1Meter
Polarization	Linear
Connector	SMA(F)/SMA(M)
Impedance	50 ohm

WiFi

Model Name	EWM-W135		EWM-W158
Part Number	EWM-W135H01E	EWM-W135F01E	EWM-W158F01E
Form Factor	Half Size Mini PCI-e	Full Size Mini PCI-e	Full Size Mini PCI-e
Wireless Standard	802.11 a/b/g/n	802.11 a/b/g/n	802.11 a/b/g/n
Chipset	Atheros AR9382	Atheros AR9382	Atheros AR9592- AR1B
Signal Protocol	PCIe Differential	PCIe Differential	PCIe Differential
Antenna	2 x U.FL connectors	2 x U.FL connectors	2 x U.FL connectors
Operating Voltage	DC 3.3V ± 5%	DC 3.3V ± 5%	DC 3.3V ± 5%
Temperature Range	-10 ~ 70 °C (Operating)	-10 ~ 70 °C (Operating)	-40 ~ 85 °C (Operating)
Dimensions (L x W x H)	26.65 x 29.85 x 3.25 mm	26.65 x 29.85 x 3.25 mm	50.8 x 29.85 x 2.86 mm
Security	64/128/152-bit WEP, WPA, WPA2, 802.1x, TKIP and AES	64/128/152-bit WEP, WPA, WPA2, 802.1x, TKIP and AES	64/128-bit WEP, WPA, WPA2, 802.1x, TKIP and AES
SISO/MIMO	2T x 2R	2T x 2R	2T2R
Data Rate	300Mbps	300Mbps	300Mbps
Bluetooth	-	-	-
O.S Supported	Win 7/ 8/ 8.1	Win 7/ 8/ 8.1	Win 7/ 8/ 8.1
Host connector type	PCIe Mini card	PCIe Mini card	PCIe Mini card

Model Name	EWM-W170	EWM-W151	EWM-W160
Part Number	EWM-W170H01E	EWM-W151H01E	EWM-W160M201E
Form Factor	Half Size Mini PCI-e	Half Size Mini PCI-e	M.2 2230 (A-E key)
Wireless Standard	802.11a/b/g/n/ac	802.11 b/g/n	802.11 b/g/n
Chipset	Atheros QCA9377-7	Realtek RTL8188EE	Realtek RTL8188EE
Signal Protocol	USB Differential	PCIe Differential	PCIe Differential
Antenna	2*U.FL connectors	1 x U.FL connectors	2 x I-PEX MHF4 connectors
Operating Voltage	DC 3.3V+-5%	DC 3.3V ± 5%	DC 3.3V ± 5%
Temperature Range	(-20~+70) (Operating)	0 ~ 80 °C (Operating)	0 ~ 70 °C (Operating)
Dimensions (L x W x H)	26.65*29.85*2.75mm	26.65 x 29.85 x 3.05 mm	22 x 30 x 2.3 mm
Security	WAPI, 64/ 128-bit WEP, WPA/WPA2 TKIP and AES	64/128-bit WEP, WPA, WPA2	64/128-bit WEP, WPA, WPA2,802.1x, TKIP and AES
SISO/MIMO	1T1R	1T1R	1T1R
Data Rate	433Mbps	150Mbps	150Mbps
Bluetooth	-	-	-
O.S Supported	win7/8/8.1/10	Win 7/ 8/ 8.1/ 10	Win 7/ 8/ 8.1/ 10
Host connector type	PCIe Mini card	PCIe Mini card	M.2 card

WiFi+BT

Model Name	EWM-W157		EWM-W162
Part Number	EWM-W157H01E	EWM-W157M201E	EWM-W162M201E
Form Factor	Half Size Mini PCI-e	M.2-2230 (A-E key)	M.2-2230(E key)
Wireless Standard	802.11 ac/a/b/g/n+BT4.0	802.11 ac/a/b/g/n+BT4.2	802.11a/b/g/n/ac+BT4.2
Chipset	Realtek RTL8821AE	Realtek RTL8821CE	Marvell 88W8897P
Signal Protocol	WiFi: PCIe BT: USB Differential	WiFi: PCIe BT: USB Differential	WiFi: PCIe BT: USB Differential
Antenna	2 x U.FL connectors	2 x I-PEX MHF4 connectors	2 x I-PEX MHF4 connectors
Operating Voltage	DC 3.3V ± 5%	DC 3.3V ± 5%	DC 3.3V ± 5%
Temperature Range	0 ~ 70 °C (Operating)	0 ~ 70 °C (Operating)	-30 ~ +80 °C (Operating)
Dimensions (L x W x H)	26.65 x 29.85 x 3.25 mm	22 x 30 x 2.3 mm	22 x 30 x 2.3 mm
Security	64/128-bit WEP, WPA, WPA2, 802.1x, TKIP and AES	64/128-bit WEP, WPA, WPA2, 802.1x, TKIP and AE	WAPI, 64/ 128-bit WEP, WPA/WPA2 TKIP and AES
SISO/MIMO	1T1R	1T1R	2T2R
Data Rate	433Mbps	433Mbps	867Mbps
Bluetooth	2.1, 2.1+EDR, 3.0, 3.0+HS, 4.0 (BLE)	2.1, 2.1+EDR, 3.0, 3.0+HS, 4.0 (BLE), 4.1,4.2	2.1, 2.1+EDR, 3.0,3.0+HS, 4.0 (BLE), 4.1, 4.2
O.S Supported	Win 7/8/8.1/10	Win 7/8/8.1/10	Linux
Host Type	PCIe Mini card	M.2 card	M.2 card

WiFi+BT

Model Name	EWM-W163	EWM-W167	EWM-W168
Part Number	EWM-W163M201E	EWM-W167M201E	EWM-W168H01E
Form Factor	M.2-2230(A-E key)	M.2-2230(E key)	Half Size Mini PCI-e
Wireless Standard	802.11a/b/g/n/ac+BT4.2	802.11b/g/n+BT4.0	802.11a/b/g/n/ac+BT4.2
Chipset	Atheros QCA6174A-5	Realtek RTL8723BS	Realtek RTL8822BE
Signal Protocol	WiFi: PCIe BT: USB Differential	WiFi: SDIO 3.0 BT: UART	WiFi: PCIe BT: USB Differential
Antenna	2 x I-PEX MHF4 connectors	1 x I-PEX MHF4 connector	2 x I-PEX MHF4 connectors
Operating Voltage	DC 3.3V ± 5%	DC 3.3V ± 5%	DC 3.3V ± 5%
Temperature Range	-20 ~ +80 °C (Operating)	0 ~ 70 °C (Operating)	0 ~ 70 °C (Operating)
Dimensions (L x W x H)	22 x 30 x 2.3 mm	22 x 30 x 2.3 mm	26.65 x 29.85 x 2.75 mm
Security	WAPI, 64/ 128-bit WEP, WPA/WPA2 TKIP and AES	WAPI, 64/ 128-bit WEP, WPA/WPA2 TKIP and AES	WAPI, 64/ 128-bit WEP, WPA/WPA2 TKIP and AES
SISO/MIMO	2T2R	1T1R	2T2R
Data Rate	867Mbps	150Mbps	867Mbps
Bluetooth	2.1, 2.1+EDR, 3.0, 3.0+HS, 4.0 (BLE), 4.1, 4.2	2.1, 2.1+EDR, 3.0, 3.0+HS, 4.0 (BLE)	2.1, 2.1+EDR, 3.0,3.0+HS, 4.0 (BLE), 4.1, 4.2
O.S Supported	win7/8/8.1/10	Linux	win7/8/8.1/10
Host Type	M.2 card	M.2 card	PCIe Mini card

Model Name	EWM-W189	EWM-W190	EWM-W188
Part Number	EWM-W189H01E	EWM-W190H01E	EWM-W188M201E
Form Factor	Half Size Mini PCI-e	Half Size Mini PCI-e	M.2-2230(A-E key)
Wireless Standard	802.11a/b/g/n/ac+BT4.2	802.11a/b/g/n/ac+BT4.2	802.11a/b/g/n/ac+BT4.2
Chipset	Atheros QCA6174A-5	Atheros QCA6174A-5	Realtek RTL8822BE
Signal Protocol	WiFi: PCIe BT: USB Differential	WiFi: PCIe BT: USB Differential	WiFi: PCIe BT: USB Differential
Antenna	2*U.FL connectors	2*U.FL connectors	2*I-PEX MHF4 connectors
Operating Voltage	DC 3.3V+-5%	DC 3.3V+-5%	DC 3.3V+-5%
Temperature Range	-10 ~ 70° C (Operating)	-40 ~ 85° C (Operating)	-10 ~ 70° C (Operating)
Dimensions (L x W x H)	26.65*29.85*2.75mm	26.65*29.85*2.75mm	22*30*2.3mm
Security	WAPI, 64/ 128-bit WEP, WPA/WPA2 TKIP and AES	WAPI, 64/ 128-bit WEP, WPA/WPA2 TKIP and AES	WAPI, 64/ 128-bit WEP, WPA/WPA2 TKIP and AES
SISO/MIMO	2T2R	2T2R	2T2R
Data Rate	867Mbps	867Mbps	867Mbps
Bluetooth	2.1,2.1+EDR,3.0,3.0+HS, 4.0(BLE), 4.1, 4.2	2.1,2.1+EDR,3.0,3.0+HS, 4.0(BLE), 4.1, 4.2	2.1,2.1+EDR,3.0,3.0+HS, 4.0(BLE), 4.1, 4.2
O.S Supported	win7/8/8.1/10	win7/8/8.1/10	win7/8/8.1/10
Host Type	PCIe Mini card	PCIe Mini card	M.2 card

Model Name	EWM-W195	EWM-W308	EWM-W306
Part Number	EWM-W195M201E	EWM-W308S01E	EWM-W306S01E
Form Factor	M.2-2230(A-E key)	M.2-1216(solder down)	M.2-1216(solder down)
Wireless Standard	802.11a/b/g/n/ac+BT4.2	802.11a/b/g/n/ac+BT4.2	802.11a/b/g/n/ac+BT5.0
Chipset	Atheros QCA6174A-5	Realtek RTL8822BE	Marvell 88W8997
Signal Protocol	WiFi: PCIe BT: USB Differential	WiFi: PCIe BT: USB Differential	SDIO
Antenna	2*I-PEX MHF4 connectors	2*I-PEX MHF4 connectors	2*I-PEX MHF4 connectors
Operating Voltage	DC 3.3V+-5%	DC 3.3V+-5%	DC 3.3V+-5%
Temperature Range	-40 ~ 85° C (Operating)	0 ~ 70° C (Operating)	(-30~+85) (Operating)
Dimensions (L x W x H)	22*30*2.3mm	12*16*1.7mm	12*16*1.7mm
Security	WAPI, 64/ 128-bit WEP, WPA/WPA2 TKIP and AES	WAPI, 64/ 128-bit WEP, WPA/WPA2 TKIP and AES	WAPI, 64/ 128-bit WEP, WPA/WPA2 TKIP and AES
SISO/MIMO	2T2R	2T2R	2T2R
Data Rate	867Mbps	867Mbps	867Mbps
Bluetooth	2.1,2.1+EDR,3.0,3.0+HS, 4.0(BLE), 4.1, 4.2	2.1,2.1+EDR,3.0,3.0+HS, 4.0(BLE), 4.1, 4.2	2.1,2.1+EDR,3.0,3.0+HS, 4.0(BLE), 4.1, 4.2, 5.0
O.S Supported	win7/8/8.1/10	win7/8/8.1/10	Linux
Host Type	M.2 card	M.2 1216 type	M.2 1216 type

Products Coming Soon in 2019

Model Name	EWM-C148	EMW-C186	EWM-NB170	EWM-W260	EWM-WP369
Form Factor	Full Size Mini PCI-e	M.2 keyB 3042	Stamp Type	M.2 2230	Stamp Type
Radio Spec	LTE CAT4	LTE CAT16	NB-IOT	802.11AX	802.11ac 802.11p
Data Rate	300Mbps	1Gbps	25.5Kbps DL/62.5Kbps UL	1.2Gbps	867Mbps
RF Spec	LTE FDD/TDD	LTE FDD/TDD	LTE NB1	WiFi/BT 5.0	WiFi /BT5.0
Main Chipset	MDM 9207	XMM 7560	MTK 2625	QCA 6290	88W9098
Signal Protocol	USB 2.0	PCI-E 2.0	UART	PCI-E/USB 2.0	PCI-E

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