# AW-CU345

## IEEE 802.11 b/g/n + Bluetooth 5.0 LE

## WLAN/BT Microcontroller Module

## Datasheet



**Rev. 0.9**

(For Standard)

# Revision History

| *Revision* | *Date* | *Description* | *Initials* | *Approved* |
|---|---|---|---|---|
| **Version0.1** | **2017/09/29** | Initial | **Alex Yu** | **Daniel Lee** |
| **Version0.2** | **2017/10/22** | Update:<br>Delete 2.2.1 Power pin VPP_BT_6V8 | **Alex Yu** | **Daniel Lee** |
| **Version0.3** | **2017/12/15** | Update:<br>Pin Definition | **Alex Yu** | **Daniel Lee** |
| **Version0.4** | **2017/12/19** | Update:<br>PCB Footprint | **Alex Yu** | **Daniel Lee** |
| **Version0.5** | **2018/03/14** | Update:<br>Coexistence use cases | **Alex Yu** | **Daniel Lee** |
| **Version0.6** | **2018/03/26** | Update:<br>Specifications Table | **Alex Yu** | **Daniel Lee** |
| **Version0.7** | **2018/05/28** | Update:<br>Antenna change to Metal Antenna<br>Mechanical Information | **Alex Yu** | **N.C. Chen** |
| **Version0.8** | **2018/09/12** | Update:<br>IC Information | **Alex Yu** | **N.C. Chen** |
| **Version0.9** | **2018/11/29** | Update:<br>Mechanical Drawing<br>Operating Conditions<br>Power Consumption<br>Certifications FCC/ETSI Bluetooth<br>2.4GHz Power Table<br>Packaging Information | **Alex Yu** | **N.C. Chen** |
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# 1. Introduction

## 1.1 Product Overview

AzureWave presents **AW-CU345** Wi-Fi/BT Microcontroller Smart Energy Platform Solution provides a highly cost-effective, flexible and easy to-use hardware/software platform to build a new generation of connected, smart devices. These smart-connected devices enable device to deliver a broad-range of services to consumers including energy-management, demand-response, home automation and remote access. This allows a user to manage comfort and convenience, also run diagnostics and receive alerts and notifications, in addition to managing and controlling the device. Developers can leverage the rich connectivity features of these new smart devices to create a new generation of innovative new applications and services.

The platform builds upon the success of Marvell's first-generation Wi-Fi/BT microcontroller platforms using the Marvell/Dialog 88MW320/DA14585 Wi-Fi/BT System-on-Chip (SoC), a 4MByte QSPI flash memory and Marvell Easy Connect software.

## 1.2 Features

### 1.2.1 WLAN

**MCUs of AW-CU345**

- 88MW320 (Marvell 88MW320 is a WLAN IEEE 802.11 b/g/n standalone SoC)
  - Processor
    - ARM Cortex-M4F, 32bit
    - 200MHz main bus clock
  - Memory
    - 128KB ROM
    - 512KB RAM
  - Flash Controller
    - 32KB SRAM cache to support XIP
    - Memory-mapped access to QSPI Flash devices
  - Wireless
    - IEEE 802.11 b/g/n HT20
    - Low-power with deep sleep and standby modes
    - Fully supports clients (stations) implementing IEEE Power Save mode
    - Wi-Fi direct connectivity

### 1.2.2 ooth

- DA14585 (Dialog DA14585 is a Bluetooth Low Energy 5.0 SoC)
  - Processor
    - ARM Cortex-M0, 32bit, 16MHz
    - Dedicated Link Layer Processor
    - AES-128 bit encryption Processor
  - Memory
    - 64 KB OTP Memory
    - 128 KB ROM
    - 96 KB Retention SRAM
  - Wireless
    - Bluetooth V5.0

### Memory of AW-CU345

- 4M Byte QSPI flash

### IO Interfaces

- UART
- SWD(JTAG)
- SSP(SPI)
- GPT(PWM)
- I2C
- ADC
- GPIO

### Package

- LGA Module – 36 mm x 18 mm x 2.5 mm  111 pin

### Antenna

- Internal Antenna for WLAN/BT
- External U.FL connector for WLAN/BT

### Certifications

- TBD

## 1.3 Block Diagram

## 1.4 Specifications Table

### 1.4.1 neral

| Features | Description |
|---|---|
| Product Description | **AW-CU345 Wireless Smart Energy module** |
| Major Chipset | **Marvell 88MW320 + Dialog DA14585 + 4MB flash** |
| Host Interface | **UART/JTAG/SSP/I2C/ADC** |
| Dimension | **36 mm x 18 mm x 2.5 mm** |
| Package | **111-pin LGA** |
| Antenna | **Function1: Internal Antenna for WLAN/BT**<br>**Function2: U.FL(external antenna) for WLAN/BT** |
| Weight | **3g** |

### 1.4.2 WLAN

| Features | Description |
|---|---|
| WLAN Standard | **IEEE 802.11b/g/n, Wi-Fi compliant** |
| Frequency Range | **2.4 GHz ISM radio band** |
| Modulation | **DSSS, OFDM, DBPSK, DQPSK, CCK, 16-QAM, 64-QAM for WLAN** |
| Number of Channels | **802.11b: USA, Canada and Taiwan – 11**<br>**Most European Countries – 13**<br>**Japan – 13**<br>**802.11g: USA, Canada and Taiwan – 11**<br>**Most European Countries – 13**<br>**Japan – 13**<br>**802.11n(HT20): Channel 1~13(2412~2472)** |
| Output Power (Board Level Limit)* | **WLAN:**<br>**Module for IEEE 802.11b/g/n spec:**<br>**802.11b 17dBm(+-2dBm) for IEEE 802.11b spec**<br>**802.11g 14dBm(+-2dBm) for IEEE 802.11g spec**<br>**802.11n 13dBm(+-2dBm) for IEEE 802.11n HT20 spec**<br><br>* FCC/CE output power limit spec:<br>- Refer to the 3.7 CERTIFICATIONS |
| Receiver Sensitivity | **WLAN:**<br>**-84dBm for 11M IEEE 802.11b**<br>**-69dBm for 54M IEEE 802.11g**<br>**-66dBm for MCS7 IEEE 802.11n HT20** |
| Data Rate | **WLAN:**<br>**802.11b: 1, 2, 5.5, 11Mbps**<br>**802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps**<br>**802.11n: MCS0-7,up to 72.2Mbps(20MHz channel)** |
| Security | **1.802.11i and 802.11w security standard.**<br>**2.WEP 64 and 128 bit encryption with hardware TKIP.**<br>**3.WLAN Authentication and privacy infrastructure.** |

### 1.4.3 Bluetooth

| Features | Description |
|---|---|
| Bluetooth Standard | **Bluetooth V5.0 complaint** |
| Frequency Range | **2402~2480MHz** |
| Modulation | **GFSK (1Mbps) for Bluetooth** |
| Output Power | **0~-4dBm** |
| Receiver Sensitivity | **-84dBm** |
| Data Rates | **Bluetooth Low Energy Only** |

### 1.4.4 Operating Conditions

| Features | Description |
|---|---|
| Operating Conditions | |
| Voltage | **3.3V +/- 9%** |
| Operating Temperature | **Operating: -30 ~ 85℃** |
| Operating Humidity | **<85%** |
| Storage Temperature | **-40 ~ 85℃** |
| Storage Humidity | **< 60 %** |
| ESD Protection | |
| Human Body Model | **2KV per JEDEC EID/JESD22-A114** |
| Changed Device Model | **250V per JEDEC EIA/JESD22-C101** |

# 2. Pin Definition

## 2.1 Pin Map( Top View )

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GND | GND | GPIO_1_2_BT | SWDIO_BT | XTAL3Kp | XTAL32Km | GPIO_1_1_BT | RESETN_BT | GPIO_2 | GPIO_3 | GPIO_49 | GPIO_46 | GPIO_48 | GPIO_47 | GND | K |
| GND | | GPIO_1_3_BT | SWCLK_BT | GPIO_0_0_BT | GPIO_0_1_BT | GPIO_25 | Don't connect debug GPIO_39 | | Don't connect debug GPIO_1 | Don't connect debug DPDT | Don't connect debug GPIO_0 | Don't connect debug GPIO_22 | GND | Floating | J |
| | | GND | | | | | GND | | | | | GND | Floating | Don't connect debug GPIO_40 | H |
| GND | GPIO_6 | GND | GND | | | GND | GND | GND | | GND | GND | GND | Floating | Don't connect debug GPIO_41 | G |
| GND | GPIO_9 | | | | | | GND | GND | GND | GND | | Don't connect debug Rx | Floating | GPIO_27 | F |
| GND | GND | GND | | GND | | | GND | GND | GND | | | Don't connect debug Tx | Floating | GPIO_16 | E |
| GND | GND | GND | GND | GND | | | | GND | | | | GND | Floating | GPIO_26 | D |
| GND | GND | GND | GND | GND | | GND | GND | | | GND | | | Floating | GPIO_25 | C |
| GND | GND | GPIO_2_5_BT | GND | VBAT_BT_3V3 | VBAT_WL_3V3 | GPIO_2_6_BT | GPIO_2_8_BT | GPIO_4 | | GPIO_7 | Floating | | GND | GPIO_24 | B |
| GND | GND | Don't connect | GND | VBAT_BT_3V3 | VBAT_WL_3V3 | GND | GPIO_2_7_BT | GPIO_2_9_BT | GPIO_10 | GPIO_8 | GPIO_5 | GPIO_23 | RESETN_WL | GND | A |

## 2.2 Pin Table

### 2.2.1 Power pin

| Pin No | Definition | Basic Description | Type | Level |
|---|---|---|---|---|
| A10 | VBAT_WL_3V3 | 88MW320/FLASH power supply. (Pin A10 with Pin B10 configuration) | A, I | 3.3V |
| B10 | VBAT_WL_3V3 | 88MW320/FLASH power supply. (Pin A10 with Pin B10 configuration) | A, I | 3.3V |
| A11 | VBAT_BT_3V3(a) | DA14585 power supply. (Pin A11 with B11 configuration) | A, I | 3.3V |
| B11 | VBAT_BT_3V3(a) | DA14585 power supply. (Pin A11 with B11 configuration) | A, I | 3.3V |

(a) The BT has to keep power supply for the module RF switch.

### 2.2.2 GPIO[88MW320] pin

| Pin No | Definition | Function 0 | Function 1 | Function 2 | Function 3 | Function 4 | Function 5 | Type | Level |
|---|---|---|---|---|---|---|---|---|---|
| G14 | GPIO_6 | JTAG TDO | GPIO_6 | I2C1_SDA | | | | I/O | 3.3V |
| F14 | GPIO_9 | JTAG TDI | GPIO_9 | UART2_TXD | SSP2_TXD | I2C1_SDA | | I/O | 3.3V |
| K7 | GPIO_2(4) | GPIO_2 | GPT0_CH2 | UART0_TXD | SSP0_TXD | | | I/O | 3.3V |
| K6 | GPIO_3(4) | GPIO_3 | GPT0_CH3 | UART0_RXD | SSP0_RXD | | | I/O | 3.3V |
| B7 | GPIO_4 | GPIO_4 | GPT0_CH4 | I2C0_SDA | AUDIO_CLK | | | I/O | 3.3V |
| A4 | GPIO_5 | GPIO_5 | GPT0_CH5 | I2C0_SCL | | | | I/O | 3.3V |
| B5 | GPIO_7(2) | JTAG TCK | GPIO_7 | UART2_CTS | SSP2_CLK | I2C0_SDA | | I/O | 3.3V |
| A5 | GPIO_8(2) | JTAG TMS | GPIO_8 | UART2_RTS | SSP2_FRM | I2C0_SDL | | I/O | 3.3V |
| A6 | GPIO_10 | JTAG TRST | GPIO_10 | UART2_RXD | SSP2_RXD | I2C1_SDL | | I/O | 3.3V |
| E1 | GPIO_16(1) | GPIO_16 | CON[5] | | AUDIO_CLK | | | I/O | 3.3V |
| A3 | GPIO_23 | WAKE_UP_1 | GPIO_23 | UART0_CTS | | | COMP_IN_P | I/O | 3.3V |
| B1 | GPIO_24(3) | OCS32K | GPIO_24 | UART0_RXD | GPT1_CH5 | | COMP_IN_N | I/O | 3.3V |
| C1/J9 | GPIO_25(3) | XTAL32K_IN | GPIO_25 | I2C1_SDA | | | | I/O | 3.3V |
| D1 | GPIO_26(3) | XTAL32K_OUT | GPIO_26 | I2C1_SCL | | | | I/O | 3.3V |
| F1 | GPIO_27(1) | GPIO_27 | CON[4] | UART0_TXD | | | | I/O | 3.3V |
| K4 | GPIO_46 | GPIO_46 | ADC_4/ ACOMP4 | UART2_CTS | SSP2_CLK | | | I/O | 3.3V |
| K2 | GPIO_47 | GPIO_47 | ADC_5/ ACOMP5 | UART2_RTS | SSP2_FRM | | | I/O | 3.3V |
| K3 | GPIO_48 | GPIO_48 | ADC_6/ ACOMP6 | UART2_TXD | SSP2_TXD | | | I/O | 3.3V |
| K5 | GPIO_49 | GPIO_49 | ADC_7/ ACOMP7 | UART2_RXD | SSP2_RXD | | | I/O | 3.3V |
| A2 | RESETN_WL | RESETn | Host reset | | | | | I | 3.3V(internal pull high 51k ohm) |

*(1) Configuration Pins Table:

| | Pin No | Definition | Function 1 Description (Configuration Bits) |
|---|---|---|---|
| AW-CU345 | F1 | GPIO_27 | 88MW320 Boot Options with CON[4], CON[5]<br>00 = boot from UART<br>11 = boot from internal QSPI Flash (default) |
| | E1 | GPIO_16 | |

*(2) 32k clock reference (sleep clock)
- External crystal-oscillator driving 32.768 KHz clock to GPIO_25
- External crystal connected to GPIO_25 & GPIO_26 at 32.768 KHz
- Connect GPIO_24 to GPIO_25 for calibration reference to RC32K

*(3) SWD support on GPIO_7 (SWDCLK) and GPIO_8 (SWDIO)
*(4) Console UART0 on GPIO_2 (TXD) and GPIO_3 (RXD)

## 2.2.3 GPIO [DA14585] pin

| Pin No | Definition | Function | Type | Level |
|---|---|---|---|---|
| J11 | GPIO_0_0_BT | Support ADC[0]. Pull-down enabled during and after reset. General purpose I/O port bit or alternate function nodes. | AIO | 3.3V |
| J10 | GPIO_0_1_BT | Support ADC[1]. Pull-down enabled during and after reset. General purpose I/O port bit or alternate function nodes. | AIO | 3.3V |
| K9 | GPIO_1_1_BT | Pull-down enabled during and after reset. General purpose I/O port bit or alternate function nodes. | I/O | 3.3V |
| K13 | GPIO_1_2_BT | Pull-down enabled during and after reset. General purpose I/O port bit or alternate function nodes. | I/O | 3.3V |
| J13 | GPIO_1_3_BT | Pull-down enabled during and after reset. General purpose I/O port bit or alternate function nodes. | I/O | 3.3V |
| B13 | GPIO_2_5_BT | Pull-down enabled during and after reset. General purpose I/O port bit or alternate function nodes. | I/O | 3.3V |
| B9 | GPIO_2_6_BT | Pull-down enabled during and after reset. General purpose I/O port bit or alternate function nodes. | I/O | 3.3V |
| A8 | GPIO_2_7_BT | Pull-down enabled during and after reset. General purpose I/O port bit or alternate function nodes. | I/O | 3.3V |
| B8 | GPIO_2_8_BT | Pull-down enabled during and after reset. General purpose I/O port bit or alternate function nodes. | I/O | 3.3V |
| A7 | GPIO_2_9_BT | Pull-down enabled during and after reset. General purpose I/O port bit or alternate function nodes. | I/O | 3.3V |
| K8 | RESET_BT | Reset signal (active high). Must be connected to GND if not used. | I | 3.3V(internal pull low 2.2k ohm) |
| J12 | SWCLK_BT | JTAG Data input/output. Bidirectional data and control communication. Can also be used as a GPIO. | I/O | 3.3V |
| K12 | SWDIO_BT | INPUT JTAG clock signal. Can also be used as a GPIO. | I/O | 3.3V |
| K10 | XTAL32Km | OUTPUT. Crystal input for the 32.768kHz XTAL. | I | 3.3V |
| K11 | XTAL32Kp | INPUT. Crystal output for the 32.768kHz XTAL. | O | 3.3V |

### 2.2.4 Ground pin

| AW-CU345 Pin No | | | | Basic Description |
|---|---|---|---|---|
| A1 | C13 | E13 | G12 | GND(CONFIGURATION PINS) |
| A9 | C14 | E14 | G13 | |
| A12 | C15 | E15 | G15 | |
| A14 | D3 | F5 | H3 | |
| A15 | D7 | F6 | H8 | |
| B2 | D11 | F7 | H13 | |
| B12 | D12 | F8 | J2 | |
| B14 | D13 | F15 | J15 | |
| B15 | D14 | G3 | K1 | |
| C5 | D15 | G4 | K14 | |
| C8 | E6 | G5 | K15 | |
| C9 | E7 | G7 | | |
| C11 | E8 | G8 | | |
| C12 | E11 | G9 | | |

### 2.2.5 FLOATING pin

| AW-CU345 Pin No | | | | Basic Description |
|---|---|---|---|---|
| B4 | G2 | H2 | | FLOATING PIN (FLOATING) |
| C2 | F2 | J1 | | |
| D2 | | | | |
| E2 | | | | |

### 2.2.6 DEBUG pin

| AW-CU345 Pin No | Basic Description |
|---|---|
| H1 | DNS(Don’t connect) |
| F3 | |
| J5 | |
| E3 | |
| G1 | |
| A13 | |
| J3 | |

| | |
|---|---|
| J4 | |
| J6 | |
| J8 | |

## 2.3 Configuration Pins

### 2.3.1 Power pin

| AW-CU345 Pin No | Basic Description |
|---|---|
| A10<br>B10 | VBAT_WL_3V3(CONFIGURATION PINS) |
| A11<br>B11 | VBAT_BT_3V3(CONFIGURATION PINS) |

### 2.3.2 CLOCK [88MW320] pin

| AW-CU345Pin No | Basic Description |
|---|---|
| C1<br>J9 | XTAL32K_IN (CONFIGURATION PINS) |

### 2.3.3 GROUND pin

| AW-CU345 Pin No | | | | Basic Description |
|---|---|---|---|---|
| A1 | C13 | E13 | G12 | GND(CONFIGURATION PINS) |
| A9 | C14 | E14 | G13 | |
| A12 | C15 | E15 | G15 | |
| A14 | D3 | F5 | H3 | |
| A15 | D7 | F6 | H8 | |
| B2 | D11 | F7 | H13 | |
| B12 | D12 | F8 | J2 | |
| B14 | D13 | F15 | J15 | |
| B15 | D14 | G3 | K1 | |
| C5 | D15 | G4 | K14 | |
| C8 | E6 | G5 | K15 | |
| C9 | E7 | G7 | | |
| C11 | E8 | G8 | | |
| C12 | E11 | G9 | | |

# 3. Electrical Characteristics

## 3.1 Absolute Maximum Ratings

| Symbol | Parameter | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| **VBAT_WL_3V3** | Power supply (input) | -- | 3.3 | 3.6 | V |
| **VBAT_BT_3V3** | Power supply (input) | -- | 3.3 | 3.6 | V |
| | | | | | |
| | | | | | |

## 3.2 Recommended Operating Conditions

| Symbol | Parameter | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| **VBAT_WL_3V3** | 3.3V power supply for 88MW320/flash | 3.0 | 3.3 | 3.6 | V |
| **VBAT_BT_3V3** | 3.3V power supply for DA14585 | 3.0 | 3.3 | 3.6 | V |
| | | | | | |
| | | | | | |

## 3.3 Digital IO Pin DC Characteristics

WLAN:

| Symbol | Parameter | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| $V_{IH}$ | Input high voltage | 3.3 *70% | | 3.3 +0.4 | V |
| $V_{IL}$ | Input low voltage | -0.4 | | 3.3 *30% | V |

**BT:**

| Symbol | Parameter | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| $V_{IH}$ | Input high voltage | 0.84 | | | V |
| $V_{IL}$ | Input low voltage | | | 0.36 | V |

## 3.4 Internal Memory

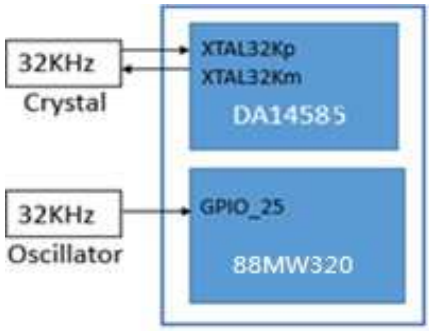
A QSPI Flash is used in AW-CU345. The size of the internal QSPI Flash is 32Mbit (4MByte).

| Manufacturer | Manufacturer's part number |
|---|---|
| GigaDevice | GD25LQ32 series |
| WinBond | W25Q32 series |

### 3.4.1 EXTERNAL 32KHZ CRYSTAL REQUIREMENTS

Two external 32.768kHz crystal and oscillator can be used for low-power consumption for BT and WLAN.

(a) Application:



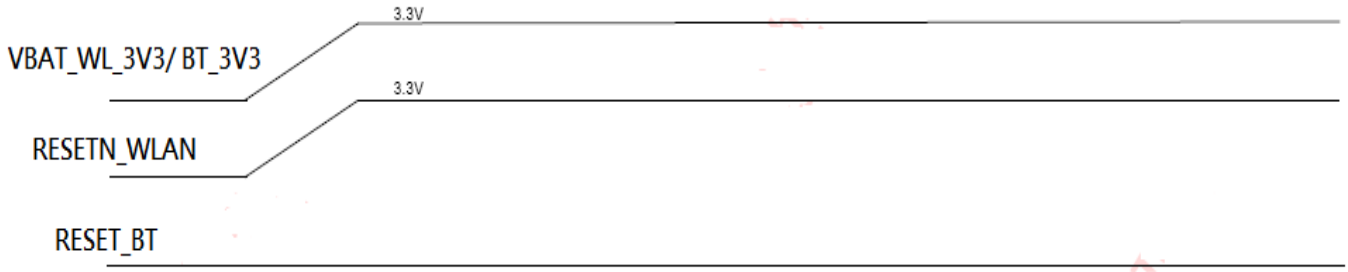

Please refer to the Page11 Configuration Pins Table for more details.

(b) Below are the specifications for this crystal.

| Parameter | Description | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CLK(EXT)}$(32K) | external clock voltage | peak-peak voltage of external clock at XTAL32Kp, pin XTAL32Km floating. note: XTAL32Kp is internally AC coupled | 0.1 | 0.2 | 1.5 | V |
| $f_{XTAL}$(32k) | crystal oscillator frequency | frequency range for an external clock (for a crystal, use either 32.000 kHz or 32.768 kHz) | 10 | 32.768 | 100 | kHz |
| ESR(32k) | equivalent series resistance | | | | 100 | kΩ |
| $C_L$(32k) | load capacitance | no external capacitors are required for a 6 pF or 7 pF crystal | 6 | 7 | 9 | pF |
| $C_0$(32k) | shunt capacitance | | | 1 | 2 | pF |
| $\Delta f_{XTAL}$(32k) | crystal frequency tolerance (including aging) | Timing accuracy is dominated by crystal accuracy. A much smaller value is preferred | -250 | | 250 | ppm |
| $P_{DRV(MAX)}$(32k) | maximum drive power | (Note ) | 0.1 | | | µW |

**Note :** Select a crystal that can handle a drive-level of at least this specification.

## 3.5 Power up Timing Sequence



## 3.6 Power Consumption

### 3.6.1 WLAN

MFG Continuous Tx Mode

| No. | Item | | | Voltage=3.3V | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Transmit | | | Receive | |
| Band (GHz) | Mode | BW (MHz) | RF Power (dBm) | Max. | Avg. | Duty. (%) | Max. | Avg. |
| 2.4 (4)(5) | 11b@1Mbps | 20 | 17 | 352mA | 305mA | 99% | 88.3mA | 82.8mA |
| | 11b@11Mbps | 20 | 17 | 348mA | 292mA | 93% | 90.9mA | 83.2mA |
| | 11g@54Mbps | 20 | 14 | 332mA | 234mA | 76% | 93.9mA | 85.2mA |
| | 11n@MCS7 | 20 | 13 | 320mA | 224mA | 75% | 93.8mA | 85.0mA |

*Current Unit:mA

### 3.6.2 Bluetooth

Tx/Rx Test Results

| No. | Mode | Packet Type | RF Power (dBm) | Voltage=3.3V | |
|---|---|---|---|---|---|
| | | | | Max. | Avg. |
| 1. | TX | LE | -2.19dBm | 3.43mA | 3.42mA |
| 2. | RX | LE | n/a | 4.95mA | 4.94mA |

Current Unit: mA

The power consumption is based on Azurewave test environment, these data for reference only.

## 3.7 Certifications FCC/ETSI WIFI Bluetooth 2.4GHz Power Table

FCC WIFI 2.4GHz power table:

Embedded Antenna(2.81dBi)

| Composite Antenna Gain Type | | Antenna Gain (dBi) | | | Chain0 | |
|---|---|---|---|---|---|---|
| No | | 2400 ~ 2483.5 MHz: | | | 2.81 | |
| Mode | Data Rate | Channel | Frequency (MHz) | Power Setting | Chain0 Avg (dBm) | Chain0 Peak (dBm) |
| 11b | 1Mbps | 1 | 2412 | 25 | 20.33 | 22.61 |
| | | 6 | 2437 | 25 | 20.39 | 22.67 |
| | | 11 | 2462 | 23 | 20.03 | 22.35 |
| 11g | 6Mbps | 1 | 2412 | 17 | 16.24 | 23.35 |
| | | 6 | 2437 | 29 | 21.95 | 25.46 |
| | | 11 | 2462 | 16 | 15.76 | 23.21 |
| 11n20 2.4G | MCS0 6.5Mbps | 1 | 2412 | 16 | 15.36 | 22.97 |
| | | 6 | 2437 | 27 | 20.16 | 25.26 |
| | | 11 | 2462 | 15 | 14.86 | 22.84 |

FCC Bluetooth 2.4GHz Power Table:

Embedded Antenna(2.81dBi)

| Composite Antenna Gain Type | | Antenna Gain (dBi) | | | Chain0 | |
|---|---|---|---|---|---|---|
| No | | 2400 ~ 2483.5 MHz: | | | 2.81 | |
| Mode | Data Rate | Channel | Frequency (MHz) | Power Setting | Chain0 Avg (dBm) | Chain0 Peak (dBm) |
| BT 5.0 | 1Mbps | 0 | 2402 | Default | -1.36 | -1.32 |
| | | 19 | 2440 | Default | -1.51 | -1.47 |
| | | 39 | 2480 | Default | -1.56 | -1.51 |

ETSI WIFI 2.4GHz Power Table:

Embedded Antenna(2.81dBi)

| Mode: | | 11b | | | | | Data Rate: | 1Mbps | | | Gain(dBi) : | | 2.81 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Channel | Freq. (MHz) | Power Setting | Conducted AVG Power (dBm) | | | | | EIRP | | | | | |
| | | | | | | | | Tnorm | Tmin | | Tmax | | Limit (dBm) |
| | | | Chain0 | | | | Total | Vnorm | Vnorm | | Vnorm | | |
| 1 | 2412 | 15 | 15.83 | | | | 15.83 | 18.64 | 19.58 | | 17.72 | | 20.00 |
| 7 | 2442 | 14 | 15.47 | | | | 15.47 | 18.28 | 19.20 | | 17.40 | | 20.00 |
| 13 | 2472 | 14 | 15.36 | | | | 15.36 | 18.17 | 19.03 | | 17.21 | | 20.00 |
| Mode: | | 11g | | | | | Data Rate: | 6Mbps | | | Gain(dBi) : | | 2.81 |
| 1 | 2412 | 15 | 15.53 | | | | 15.53 | 18.34 | 19.24 | | 17.18 | | 20.00 |
| 7 | 2442 | 16 | 15.74 | | | | 15.74 | 18.55 | 19.36 | | 17.48 | | 20.00 |
| 13 | 2472 | 15 | 15.85 | | | | 15.85 | 18.66 | 19.78 | | 17.58 | | 20.00 |
| Mode: | | 11n20 2.4G | | | | | Data Rate: | MCS0 6.5Mbps | | | Gain(dBi) : | | 2.81 |
| 1 | 2412 | 15 | 15.47 | | | | 15.47 | 18.28 | 19.35 | | 17.28 | | 20.00 |
| 7 | 2442 | 14 | 15.33 | | | | 15.33 | 18.14 | 19.15 | | 17.13 | | 20.00 |
| 13 | 2472 | 15 | 15.84 | | | | 15.84 | 18.65 | 19.59 | | 17.61 | | 20.00 |

ETSI Bluetooth 2.4GHz Power Table:

Embedded Antenna(2.81dBi)

| Mode: | | BT LE-GFSK_5 | | | | | Data Rate: | 1Mbps | | | Gain(dBi) : | | 2.81 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Channel | Freq. (MHz) | Power Setting | Conducted AVG Power (dBm) | | | | | EIRP | | | | | |
| | | | | | | | | Tnorm | Tmin | | Tmax | | Limit (dBm) |
| | | | Chain0 | | | | Total | Vnorm | Vnorm | | Vnorm | | |
| 0 | 2402 | Default | -0.52 | | | | -0.52 | 2.29 | 3.24 | | 1.29 | | 20.00 |
| 19 | 2440 | Default | -0.66 | | | | -0.66 | 2.15 | 3.01 | | 1.14 | | 20.00 |
| 39 | 2480 | Default | -0.80 | | | | -0.80 | 2.01 | 2.91 | | 1.06 | | 20.00 |

## 3.8 Coexistence use cases

1.BLE only case

•If WLAN MCU is in sleep or powered down mode, then WLAN_EIP is LOW so BLE firmware would configure antenna controller to give desired antenna to BLE.

2.WLAN only case

• In this case there is no BLE Tx/Rx scheduled so BLE_EIP is LOW.

•From WLAN MCU WLAN_EIP is always HIGH because WLAN is doing Tx/Rx.

•On WLAN_EIP rising edge, BLE firmware will configure antenna controller and gives desired antenna to WLAN.

3. BLE + WLAN case

•During BLE activity BLE_EIP will be HIGH.

•If BLE priority is HIGH then,

a. WLAN firmware will block WLAN Tx and pull WLAN_EIP to LOW.

b. On WLAN_EIP falling edge, BLE firmware will configure antenna controller to give desired antenna to BLE.

•If BLE priority is LOW then,

a. WLAN_EIP was already HIGH, BLE firmware had already given desired antenna to WLAN, so WLAN will retain the antenna.

**FEDERAL COMMUNICATIONS COMMISSION INTERFERENCE STATEMENT**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on,

the user is encouraged to try to correct the interference by one or more of the following measures:

-Reorient or relocate the receiving antenna.

-Increase the separation between the equipment and receiver.

-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-Consult the dealer or an experienced radio/ TV technician for help.

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This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

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**CAUTION:**

Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment.

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This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

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**End Product Labeling**

This transmitter module is authorized only for use in device where the antenna may be installed such that 20cm may be maintained between the antenna and users.

The final end product must be labeled in a visible area with the following: "Contains FCC ID: TLZ-CU345 ”

**Information for the OEMs and Integrators**

The following statement must be included with all versions of this document supplied to an OEM or integrator, but should not be distributed to the end user.

1) This device is intended for OEM integrators only.

2) Please see the full Grant of Equipment document for other restrictions.

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**Radiation Exposure Statement:**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

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