

User Manual

Embedded M2M Module with 802.11b/g/n 1T1R WiFi

(Project Name)	Embedded M2M Module with Broadcom 802.11bgn(1x1) WiFi single chip
(Foxconn Part No.)	T77H497.00
(Customer Part No.)	EMW3165

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1. Introduction

Project Name: Embedded M2M Module with Broadcom 802.11bgn (1x1) WiFi.

Project Number: 15020044

This documentation describes the engineering requirements specification of WiFi module with 15020044 . It is a confidential document of Foxconn.

1.1 RF module Overview

This M2M (Machine to Machine) module integrates 32 bit MCU and Broadcom WiFi. It provides wireless modem functionality utilizing direct sequence spread spectrum and OFDM/CCK technology. It operates in 2.4GHz ISM band, compatible with the IEEE 802.11b/g/n standard. It can implement the wireless network function on the embedded devices easily and improve the product' s competitiveness. It supports TCP/IP protocol and all of the Wi-Fi security. This module has implemented some efficient mechanisms in its software and hardware to maximize the performance.

The functional block diagram is shown in Figure .1.

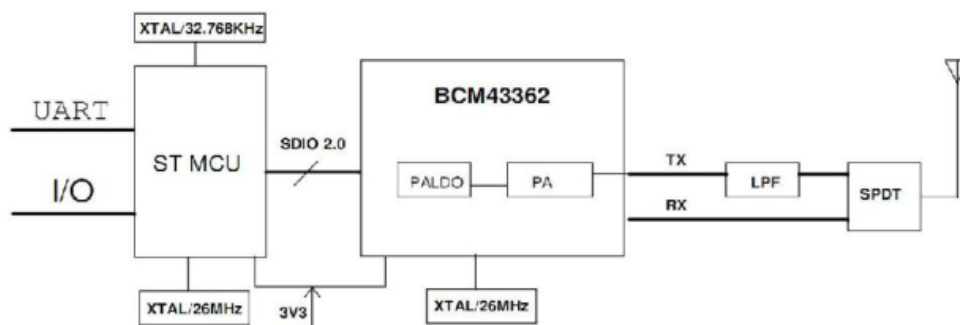


Figure 1 Module Block Diagram

1.2 Specification reference

This specification is based on additional references listed below.

- IEEE Std. 802.11b
- IEEE Std. 802.11g
- IEEE Std. 802.11n

1.3 System Functions

Table 4.1 RF Specification

Item	Specification
Operating Frequency	2412-2462MHz
Wi-Fi Standard	802.11b/g/n(single stream n)
Modulation Type	11b: DBPSK, DQPSK,CCK for DSSS 11g: BPSK, QPSK, 16QAM, 64QAM for OFDM 11n: MCS0~7,OFDM *
Data Rates	11b:1, 2, 5.5 and 11Mbps 11g:6, 9, 12, 18, 24, 36, 48 and 54 Mbps 11n: MCS0~7, up to 72Mbps
Antenna type	PCB printed ANT U.FL connector for external antenna (Optional)

Table1: General Specification as below:

Sample picture is as below.



TOP

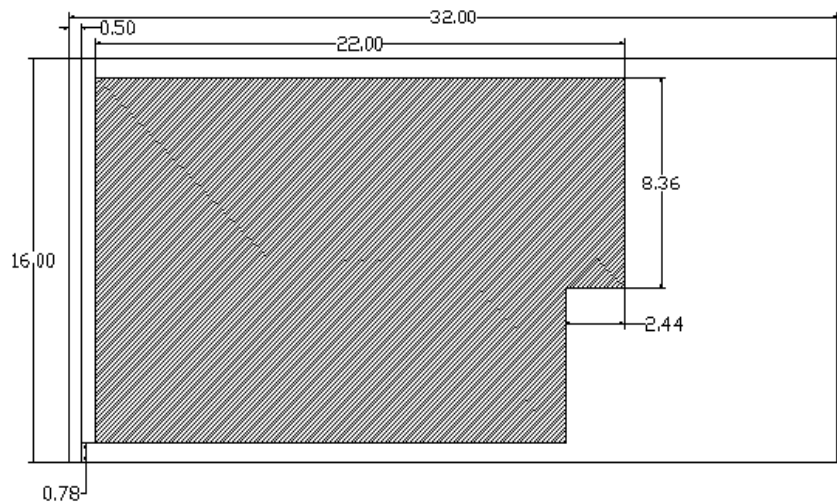
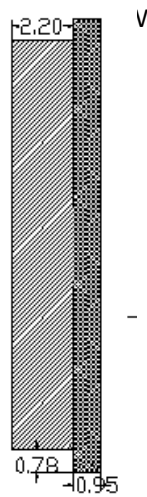
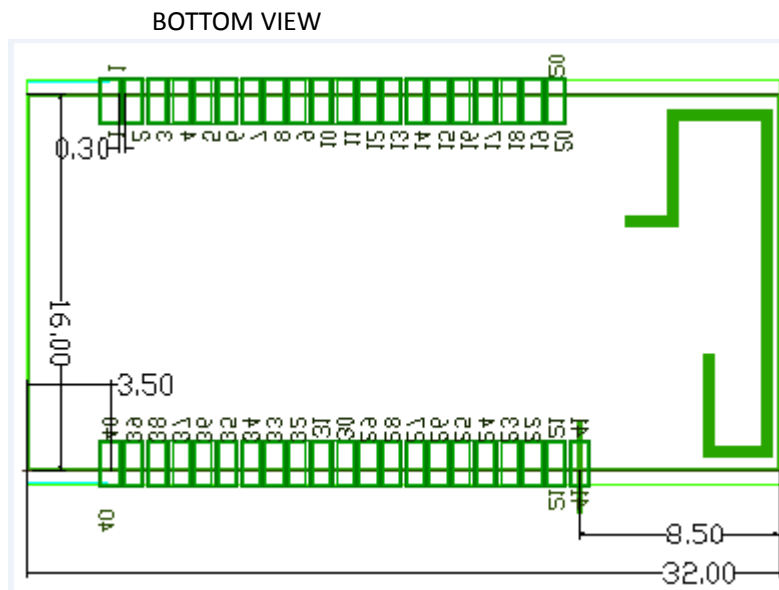


BOTTOM

2. Mechanical Specification

2.1 Mechanical Drawing

Typical Dimension (W x L x T): 32.00x16.00x3.15mm



2.2 41pin QFN Pin definition

The pin definition is as below, and its pin number refers to item 2.1.

No	Name	Type	Description
1	NC	I/O	No function
2	PB2	I/O	GPIO PIN
3	NC	I/O	No function
4	NC	I/O	
5	NC	I/O	
6	NC	I/O	
7	NC	I/O	
8	PA2	I/O	GPIO PIN
9	PA1	I/O	GPIO PIN
10	VBAT	I/O	MCU operating voltage input (power supply for RTC, external clock, 32 kHz oscillator and backup registers (through power switch) when VDD is not present.)
11	NC	I/O	No function
12	PA3	I/O	GPIO PIN
13	MICRO_RST_N	I/O	MCU Reset
14	WAKE_UP	I/O	Wake up
15	NC	I/O	No function
16	PC13	I/O	GPIO PIN
17	I2C2_SCL (PB10)	I/O	I2C_SCL
18	I2C2_SDA (PB9)	I/O	I2C_SDA
19	I2C2_SMBA	I/O	I2C_SMBA
20	GND	—	Ground
21	GND	—	Ground
22	JTAG_TDO	I/O	JTAG_TDO
23	JTAG_TDI	I/O	JTAG_TDI
24	JTAG_TRST_L	I/O	JTAG_TRST_L
25	JTAG_TCK	I/O	JTAG_TCK
26	JTAG_TMS	I/O	JTAG_TMS
27	USART1_RTS	I/O	HCI UARTrequest to send
28	NC	I/O	No function
29	USART1_RX	I/O	HCI UART receive input
30	USART1_TX	I/O	HCI UART transmit output
31	PB8	I/O	GPIO PIN
32	NC	I/O	No function
33	PB13	I/O	GPIO PIN
34	PA5	I/O	GPIO PIN
35	USART1_CTS	I/O	HCI UARTclear to send
36	PB1	I/O	GPIO PIN
37	PB0	I/O	GPIO PIN
38	PA4	I/O	GPIO PIN
39	VDD_3V3	V	Power supply input
40	VDD_3V3	V	Power supply input
41	ANT	O	RF OUTPUT(option)

3. Electrical Specification

3.1 802.11b Mode

Table 4.2 IEEE802.11b mode specification

Item	Specification
Modulation Type	DSSS / CCK
Frequency range	2412-2462MHz
Channel	CH1 to CH14
Data rate	1, 2, 5.5, 11Mbps

Table 4.3 IEEE802.11b mode TX characteristics

TX Characteristics	Min.	Test Data	Max.	Unit
Transmitter Output Power				
11b Target Power	13.5	16.2	16.5	dBm
Spectrum Mask @ target power				
fc +/-11MHz to +/-22MHz	-	-41.73	-30	dBr
fc > +/-22MHz	-	-51.89	-50	dBr
Frequency Error	-20	3.9	+ 20	ppm
Constellation Error(peak EVM)@ target power				
1~11Mbps	-	-25.52	-9	dB

Table 4.4 IEEE802.11b mode RX characteristics

RX Characteristics	Min.	Test data	Max.	Unit
Minimum Input Level Sensitivity				
1Mbps (FER≤8%)	-	-87	-83	dBm
2Mbps (FER≤8%)	-	-85	-80	dBm
5.5Mbps (FER≤8%)	-	-83	-79	dBm
11Mbps (FER≤8%)	-	-80	-76	dBm

3.2 802.11g Mode

Table 4.5 IEEE802.11g mode specification

Item	Specification
Modulation Type	OFDM
Frequency range	2412-2462MHz
Channel	CH1 to CH14
Data rate	6, 9, 12, 18, 24, 36, 48, 54Mbps

Table 4.6 IEEE802.11g mode TX characteristics

TX Characteristics	Min.	Test data	Max.	Unit
Transmitter Output Power				
11gTarget Power	11.5	14.16	14.5	dBm
Spectrum Mask @ target power				
fc +/-11MHz	-	-31.61	-20	dBm
fc +/-20MHz	-	-40.73	-28	dBm
fc > +/-30MHz	-	-43.54	-40	dBm
Frequency Error	-20	3.9	+ 20	ppm
Constellation Error(peak EVM)@ target power				
54Mbps		-28.52	-25	dB

Table 4.7 IEEE802.11g mode RX characteristics

RX Characteristics	Min.	Test data	Max.	Unit
Minimum Input Level Sensitivity				
6Mbps (FER $\leq$ 10%)	-	-87	-82	dBm
9Mbps (FER $\leq$ 10%)	-	-85	-80	dBm
12Mbps (FER $\leq$ 10%)	-	-84	-79	dBm
18Mbps (FER $\leq$ 10%)	-	-82	-77	dBm
24Mbps (FER $\leq$ 10%)	-	-80	-74	dBm
36Mbps (FER $\leq$ 10%)	-	-79	-70	dBm
48Mbps (FER $\leq$ 10%)	-	-77	-66	dBm
54Mbps (FER $\leq$ 10%)	-	-75	-65	dBm

3.3 802.11n HT20 Mode

3.1 IEEE802.11n 20MHz bandwidth mode

Table 4.8 IEEE802.11n mode specification

Item	Specification
Modulation Type	MIMO-OFDM
Channel	CH1 to CH14
Data rate	MCS0/1/2/3/4/5/6/7

Table 4.9 IEEE802.11n mode TX characteristics

TX Characteristics	Min.	Test data	Max.	Unit
Transmitter Output Power				
11n HT20 Target Power	10.5	13.43	13.5	dBm
Spectrum Mask @ target power				
fc +/-11MHz	-	-30.23	-20	dBr
fc +/-20MHz	-	-38.48	-28	dBr
fc > +/-30MHz	-	-44.8	-40	dBr
Frequency Error	-20	3.9	+ 20	ppm
Constellation Error(peak EVM)@ target power				
MCS7	-	-28.59	-28	dB

Table 4.10 IEEE802.11n mode RX characteristics

RX Characteristics	Min.	Test data	Max.	Unit
Minimum Input Level Sensitivity				
MCS0 (FER $\leq$ 10%)	-	-85	-82	dBm
MCS1 (FER $\leq$ 10%)	-	-83	-79	dBm
MCS2 (FER $\leq$ 10%)	-	-82	-77	dBm
MCS3 (FER $\leq$ 10%)	-	-80	-74	dBm
MCS4 (FER $\leq$ 10%)	-	-78	-70	dBm
MCS5 (FER $\leq$ 10%)	-	-74	-66	dBm
MCS6 (FER $\leq$ 10%)	-	-72	-65	dBm
MCS7 (FER $\leq$ 10%)	-	-69	-64	dBm

Warning statement

FCC STATEMENT

1. 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.

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

2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: 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.

FCC 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.

The EMW3165 module is designed to comply with the FCC statement. FCC ID is P53-EMW3165. The host system using EMW3165, should have label indicated FCC ID P53-EMW3165.

This device must not be co-located or operating in conjunction with any other radio.

For OEM only PCB antenna and external antenna can be used. as below

PCB antenna Specification information

Frequency (MHz)	2400	2450	2500
Efficiency (%)	-1.8	-1.58	-2.17
Efficiency (dB)	66.07	69.5	60.67
3D Peak Gain (dBi)	1.98	2.01	1.45

External antenna Specification information

- **Product Type** • external Wireless LAN Antenna
- **model** • **CAN43130WLOT02571**
- **manufacturers** • **Yageo** (Taiwan) Ltd.

Specifications for Antennas

Frequency Range (GHz)	2.40 ~ 2.50
VSWR	2.5 : 1 max
Peak Gain:	2dBi for 2.4GHz band
Radio Connector	Compatibel
Impedance	50 Ω Nominal.
Cable Diameter	1.13 mm
Cable Color	Black for Main WLAN
Operating Temperature	-40~90℃
Maximum Power	1W
Polarization	Linear
Radiation Pattern	Omni-directional

1.2 Antenna Dimension / Cable Length

Product	EVR (Automotive Media Center)
Bluetooth Antenna	40*8*0.4 mm / 50.0 mm, Color Black

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