AzureWave AW-HM610 Wireless LAN Module Owner's Manual

AzureWave Technologies, Inc.

Contents

AzureWave AW-HM610 Wireless LAN Module Owner's Manual

Features

General

- Supports 902 ~ 928MHz frequency band
- Supports single-stream 150kbps ~ 15Mbps data rate
- Supports AP and STA mode

Host interface

- UART and HSPI support for host interface

Standards Supported

- IEEE Std 802.11ah standard
- Security: OPEN, WPA2-PSK(AES), WPA3- OWE, WPA3-SAE

MAC Features

- S1G Beacon, NDP Control frame, TIM compression, unified scaling factor for max Idle period/listen interval/WNM-sleep interval, STA Type, S1G baseline functions (DCF, HCF, multi-rate support, A-MPDU), and S1G BSS operation
- Network efficiency enhancements: NDP PSPoll/ PS-Poll Ack/Probe Req./Probe Resp., RAW avoidance, TSBTT, and differentiated EDCA Parameter
- Power saving: Non-TIM operation, dynamic AID assignment and TWT
- BSS scalability (up to 8192 STAs): Multicast AID, and authentication control
- Low-cost STA/AP: EL operation, Flow Control
- Supports transmission of Standby Radio frame

Peripheral Interfaces

- I2C, SPI and UART
- A Wi-Fi dedicated HSPI for data transfer to Host

Peripheral Interfaces

- Full IEEE 802.11ah compatibility with enhanced performance
- Single-stream up to 15Mbps data rate
- Supports 1/2/4 MHz channel with optional SGI
- Supports S1G_1M, Short/Long format
- Modulation: OFDM with BPSK, QPSK, 16QAM, 64QAM

Revision History

1. Introduction

1.1 Product Overview

AzureWave Technologies, Inc. introduces the pioneer of the IEEE 802.11ah WIFI solder down module — AW-HM610. The AW-HM610 is the smallest IEEE 802.11ah Wi-Fi module that operates in the Sub 1GHz license-exempt band, offering longer ranger and higher data rate for internet of things (IoT) applications. The AW-HM610 supports 1/2/4 MHz channel bandwidth which yields 150 Kbps to 15 Mbps PHY rate that can handle low-rate sensors to high-rate surveillance camera applications. The self-contained Wi-Fi networking with huge range of data throughput offers the ideal solution to add Wi-Fi connectivity to IoT products with low power consumption requirements.

The AW-HM610 integrated Newracom NRC7394 which is a complete radio front-end that is optimized for Sub 1 GHz band. It has a fully integrated PA and fractional-N synthesizer. An embedded Cortex-M3 ARM® processor in the NRC7394 offers enough processing power to accommodate Wi- Fi subsystem as well as user application in a single Wi-Fi SoC. NRC7394 also includes two host interfaces, HSPI and UART, and rich peripherals such as general SPI, I2C, UART, PWM, auxiliary ADC, and GPIOs. The low-leakage retention memory inside NRC7394 can be used to store code and data necessary for fast wake-up from deep-sleep mode.

1.2 Block Diagram

TBD

1.3 Specifications Table

1.3.1 General

Features	Description
Product Description	IEEE 802.11ah Wireless LAN Module
Major Chipset	Newracom NRC7394 (49-pin QFN)
Host Interface	SPI
Dimension	12mm x 12mm x 1.91mm (Tolerance remarked in mechanical drawing)
Form Factor	LGA module, 44 pins
Antenna	• For LGA, "1T1R, external" ANT Main：TX/RX
Weight	0.7g

1.3.2 WLAN

<table>
<tr><th>Features</th><th>Description</th></tr>
<tr><td>WLAN Standard</td><td>IEEE 802.11ah</td></tr>
<tr><td>Frequency Rage</td><td>(US/CA): Unit MHz
1MHz Bandwidth:
902.5, 903.5, 904.5, 905.5, 906.5, 907.5, 908.5, 909.5, 910.5, 911.5, 912.5, 913.5, 914.5, 915.5, 916.5, 917.5, 918.5, 919.5, 920.5, 921.5, 922.5, 923.5, 924.5, 925.5, 926.5, 927.5

2MHz Bandwidth:
903, 905, 907, 909, 911, 913, 915, 917, 919, 921, 923, 925, 927

4MHz Bandwidth:
906, 910, 914, 918, 922, 926</td></tr>
<tr><td>Modulation</td><td>OFDM, BPSK, QPSK, 16-QAM, 64-QAM</td></tr>
<tr><td>Channel Bandwidth</td><td>1/2/4 MHz</td></tr>
<tr><td>Output Power
(Board Level Limit)*</td><td>
<table>
<tr><th></th><th>Min</th><th>Typ</th><th>Max</th><th>Unit</th></tr>
<tr><td>MCS0 (1/2/4 MHz)
@EVM≦-5dB</td><td></td><td>15</td><td>16</td><td>dBm</td></tr>
<tr><td>MCS7 (1/2/4 MHz)
@EVM≦-27dB</td><td></td><td>11</td><td>12</td><td>dBm</td></tr>
</table>
</td></tr>
<tr><td>Receiver Sensitivity</td><td>
<table>
<tr><th></th><th>Min</th><th>Typ</th><th>Max</th><th>Unit</th></tr>
<tr><td>MCS0 (1 MHz)</td><td></td><td>-101</td><td>-99</td><td>dBm</td></tr>
<tr><td>MCS0 (2 MHz)</td><td></td><td>-98</td><td>-96</td><td>dBm</td></tr>
<tr><td>MCS0 (4 MHz)</td><td></td><td>-97</td><td>-95</td><td>dBm</td></tr>
<tr><td>MCS7 (1 MHz)</td><td></td><td>-84</td><td>-82</td><td>dBm</td></tr>
<tr><td>MCS7 (2 MHz)</td><td></td><td>-80</td><td>-78</td><td>dBm</td></tr>
<tr><td>MCS7 (4 MHz)</td><td></td><td>-78</td><td>-76</td><td>dBm</td></tr>
</table>
</td></tr>
<tr><td>Data Rate</td><td>■ 1 MHz Bandwidth: up to 3Mbps
■ 2 MHz Bandwidth: up to 6.5Mbps
■ 4 MHz Bandwidth: up to 13.5Mbps</td></tr>
<tr><td>Security</td><td>■ OPEN, WPA2-PSK(AES), WPA3-OWE, WPA3-SAE
standard</td></tr>
</table>

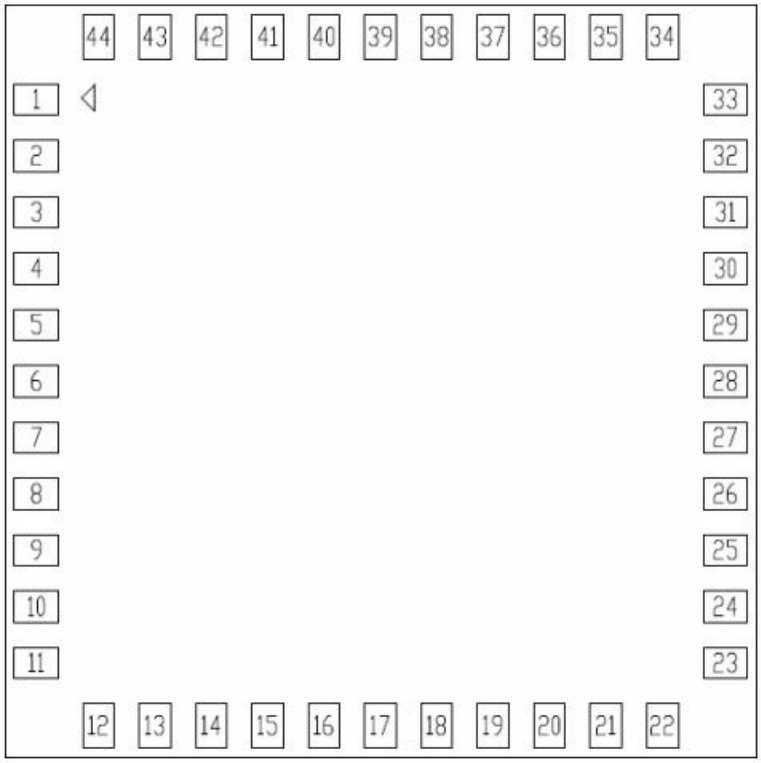
* If you have any certification questions about output power please contact FAE directly.

1.3.3 Operating Conditions

Features	Description
Operating Conditions	
Voltage	VBAT: 3.3V VDDIO: 1.8/3.3V
Operating Temperature	-40℃~85 ℃
Operating Humidity	less than 85%R.H
Storage Temperature	-40℃~85 ℃
Storage Humidity	less than 60%R.H
ESD Protection	
Human Body Model	TBD
Changed Device Model	TBD

2. Pin Definition

2.1 Pin Map



AW-HM610 Pin Map (Top View)

2.2 Pin Table

Pin No.	Definition	Basic Description	Voltage	Type
1	GND	GROUND		GND
2	ANT	RF IN/OUT		I/O
3	GND	GROUND		GND
4	NC	No Connection		
5	NC	No Connection		
6	GP25	General IO port 25		I/O
7	NC	No Connection		
8	NC	No Connection		
9	VBAT	3.3V power supply	3.3V	Power
10	GND	GROUND		GND
11	GND	GROUND		GND
12	RSTn / PMS_POR_O	Hardware reset input and POR reset output. (active low)		I/O
13	NC	No Connection		
14	NC	No Connection		
15	HSPI_nCS	HSPI chip select		I/O
16	HSPI_MOSI	HSPI MOSI		I/O
17	HSPI_CLK	HSPI clock		I/O
18	HSPI_MISO	HSPI MISO		I/O
19	NC	No Connection		
20	GND	GROUND		GND
21	NC	No Connection		
22	VDDIO	I/O supply Input		Power

23	NC	No Connection		
24	NC	No Connection		
25	MODE	Chip boot mode For XIP boot, connect to VDD For ROM boot, connect to GND		I
26	HSPI_EIRQ	HSPI external IRQ EIRQ will be Hi-z by every reset condition External pull-up or pull-down may be required depends on system application		I/O
27	GP20	General IO port 20		I/O
28	GP8 / UART0_TXD	If MODE is connected to GND, default serial TXD. General IO port 8.		I/O
29	GP9 / UART0_RXD	If MODE is connected to GND, default serial RXD. General IO port 9.		I/O
30	GP14 / JTAG_nTRST	JTAG nTRST input General IO port 14		I/O
31	GND	GROUND		GND
32	NC	No Connection		
33	GND	GROUND		GND
34	GP18 / AUXADCIN1	AUX ADC input 1 General IO port 18		I/O
35	GP17 / AUXADCIN0	AUX ADC input 0 General IO port 17		I/O
36	GND	GROUND		GND
37	NC	No Connection		
38	GP24	General IO port 24		I/O
39	GP12 / JTAG_TDO	JTAG data output General IO port 12		I/O
40	NC	No Connection		
41	GP10 / JTAG_TMS	JTAG mode selection General IO port 10		I/O
42	GP13 / JTAG_TDI	JTAG data input. General IO port 13		I/O
43	NC	No Connection		
44	GP11 / JTAG_TCK	JTAG clock General IO port 11		I/O

3. Electrical Characteristics

3.1 Absolute Maximum Ratings

Symbol	Parameter	Minimum	Typical	Maximum	Unit
VBAT	3.3V power supply	-0.5		3.8	
VDDIO	I/O supply Input	-0.5		3.8	
T_{stg}	Storage temperature	-40	-	85	℃

3.2 Recommended Operating Conditions

Symbol	Parameter	Minimum	Typical	Maximum	Unit
VBAT	3.3V power supply	2.4	3.3	3.6	V
VDDIO	3.3V I/O supply Input	3.0	3.3	3.6	V
VDDIO	1.8V I/O supply Input	1.68	1.8	1.92	V

3.3 Digital IO Pin DC Characteristics

VDDIO = 3.3V

Symbol	Parameter	Minimum	Typical	Maximum	Unit
V_{IH}	Input high voltage	2	-	3.6	V
V_{IL}	Input low voltage	-0.3	-	0.8	V
V_{OH}	Output high voltage	2.4	-		V
V_{OL}	Output low voltage		-	0.4	V

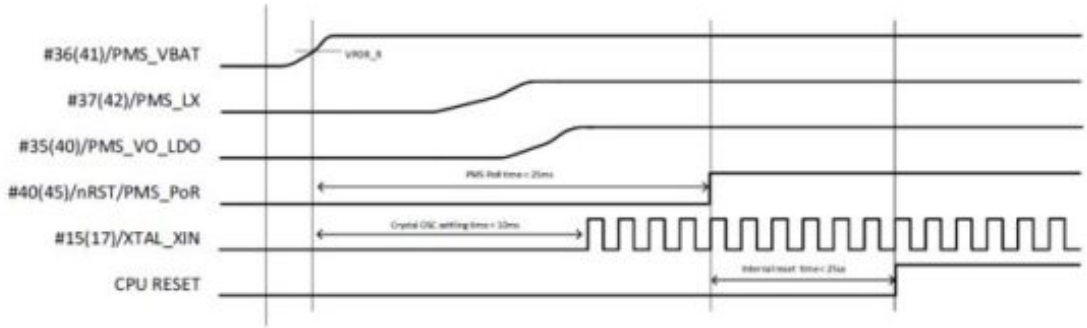
VDDIO = 1.8V

Symbol	Parameter	Minimum	Typical	Maximum	Unit
V_{IH}	Input high voltage	1.17	-	1.8	V
V_{IL}	Input low voltage	-0.3	-	0.63	V
V_{OH}	Output high voltage	1.35	-		V
V_{OL}	Output low voltage		-	0.45	V

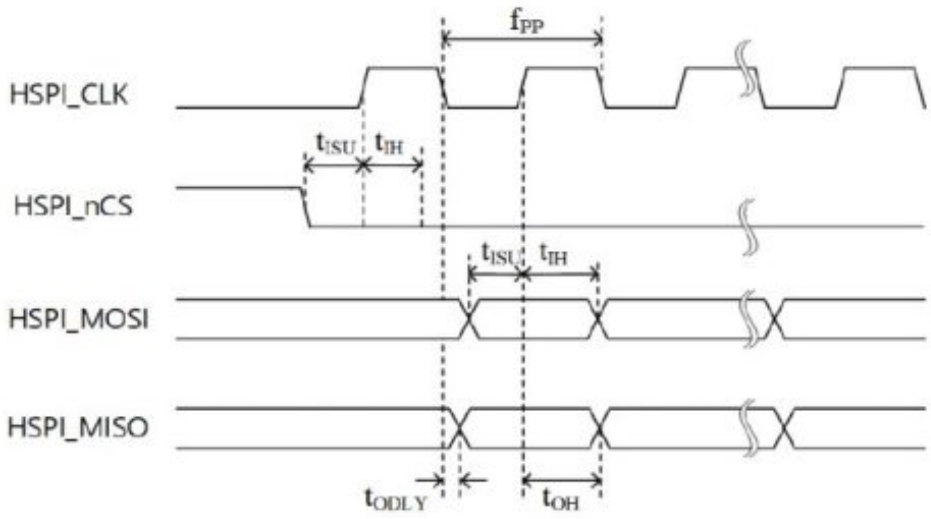
3.4 Timing Sequence

3.4.1 Power on sequence

The figure below shows the module power on sequence. The start of the POR circuit in the PMS block and BUCK oscillator are triggered by VBAT when the level exceeds a predefined voltage level. The main 32 MHz crystal oscillator starts to run when the internal power supply is stable. The PMS_PoR (active low) is de-asserted after a pre-defined settling time for stable crystal oscillation to ensure reliable SoC operation. PMS_PoR is open-drain circuit with internal pull-up resistor and connected with external RSTn pin. When the PMS_PoR releases RSTn pin to HIGH, the power-on sequence is completed and the SoC can control the entire system after the internal 25usec reset time.

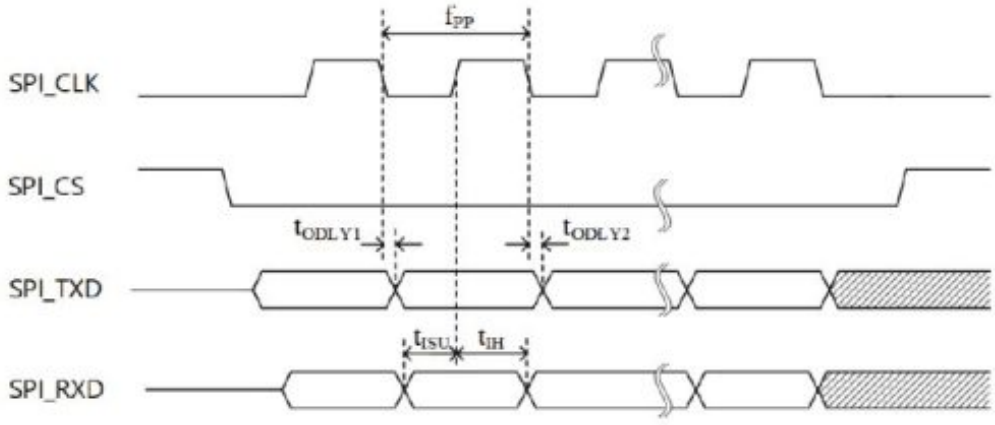


3.4.2 HSPI Timing



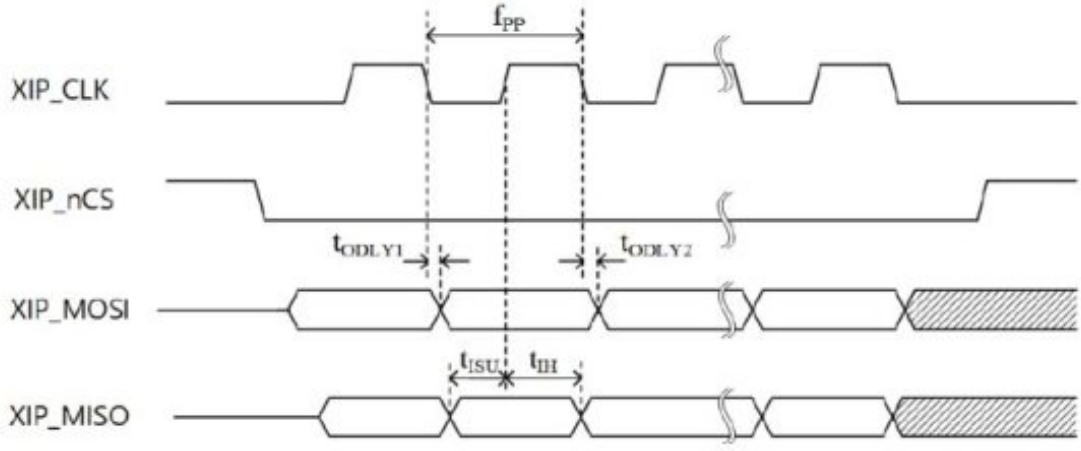
Symbol	Parameter	Min	Typ	Max	Unit
f_{PP}	Frequency	-	-	20	MHz
t_{ODLY}	Output delay time	2.7	-	20.2	ns
t_{OH}	Output hold time	25	-	-	ns
t_{ISU}	Input setup time	-	-	21.6	ns
t_{IH}	Input hold time	5.8	-	-	ns

3.4.3 SPI Timing



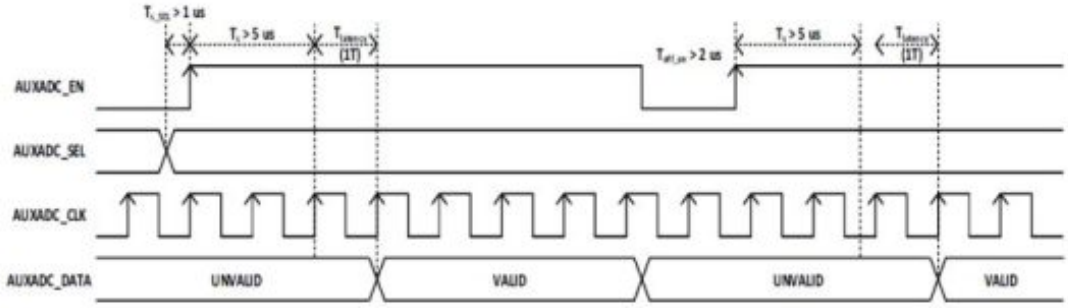
Symbol	Parameter		Min	Typ	Max	Unit
f_{PP}	Frequency	master	-	-	16	MHz
		slave	-	-	2	MHz
t_{ODLY1}	Output delay time1		0	-	23	ns
t_{ODLY2}	Output delay time2		0	-	23	ns
t_{ISU}	Input setup time		18	-	-	ns
t_{IH}	Input hold time		20	-	-	ns

3.4.4 XIP(eXecute In Place) Timing



Symbol	Parameter	Min	Typ	Max	Unit
f_{PP}	Frequency	-	-	32	MHz
t_{ODLY1}	Output delay time1	0	-	15	ns
t_{ODLY2}	Output delay time2	0	-	15	ns
t_{ISU}	Input setup time	-	-	5.1	ns
t_{IH}	Input hold time	7.7	-	-	ns

3.4.5 AUXADC Timing



Symbol	Parameter	Min	Typ	Max	Unit
Input Range	Input signal range	0.1		0.9	V
Output Range	Output Code Range (After s/w compensation)	100		900	10-bit
FS	Sampling Clock	-	2	-	MHz
Latency	Conversion latency (1 cycle = T)	-	1	-	cycle
N	Resolution	-	10	-	Bit
RIN	Input impedance	-	4	-	Mohms
Ts	Settling time after enable	5			us
Ts_sel	Setup time of AUXADC_SEL	1			us
Toff_on	Reset time	2			us
I_active	Current consumption (1.1 V)	-	-	150	uA
I_down	Power-down current (1.1 V)	-	-	2	uA

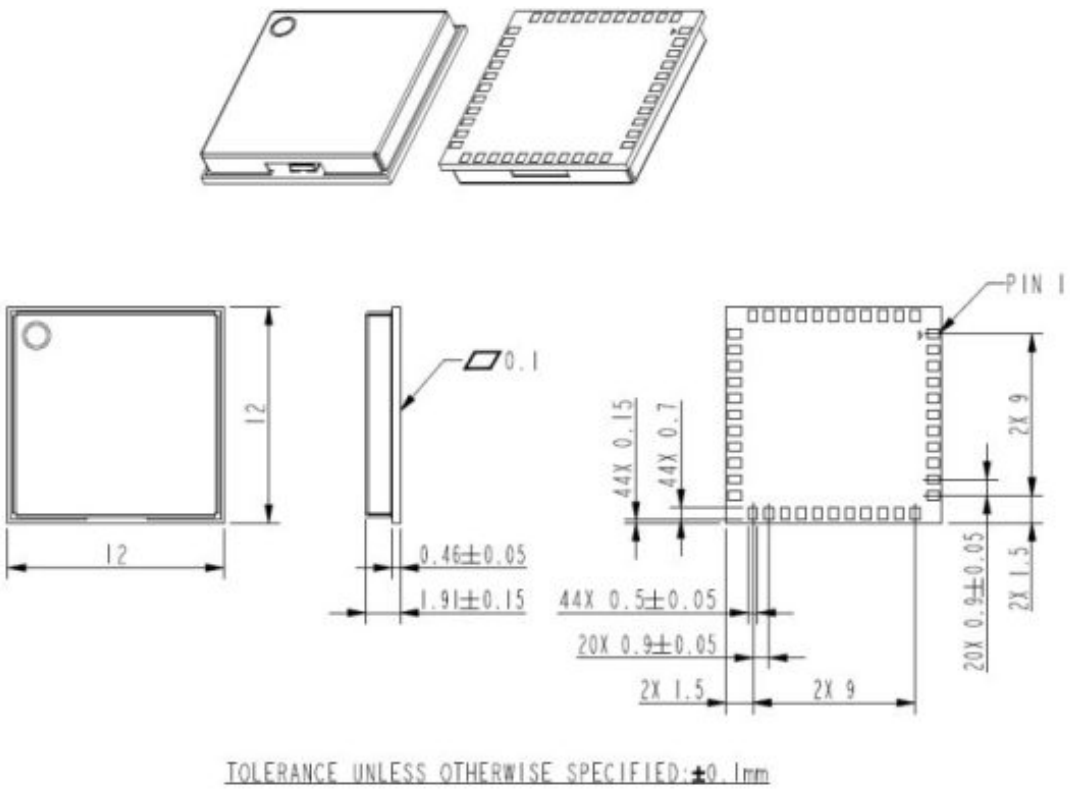
3.5 Power Consumption

3.5.1 Current Consumption Results

MODE	DUT Status	VDDIO (mA) 3.3V	VBAT (mA) 3.3V
802.11ah (1/2/4MHz BW)	Tx@10dBm	1.9mA	164mA
	Tx@13dBm	1.93mA	174mA
	Tx@15dBm	1.95mA	186mA
	Continuous Rx @ -85 dBm	1.61mA	21mA
	Deep Sleep mode	0.0001mA	0.0035mA

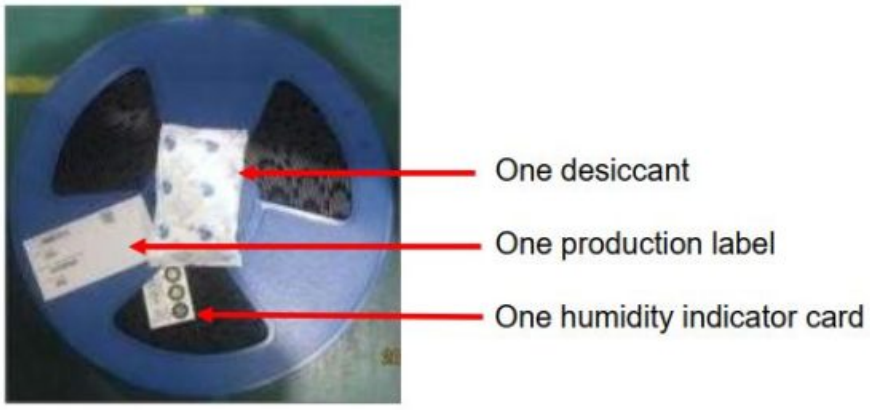
4. Mechanical Information

4.1 Mechanical Drawing

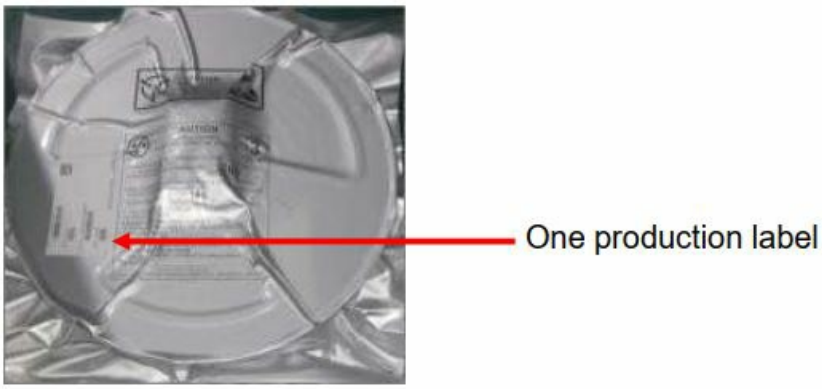


5. Package information

1. One reel can pack 1500pcs
2. One production label is pasted on the reel, one desiccant and one humidity indicator card are put on the reel

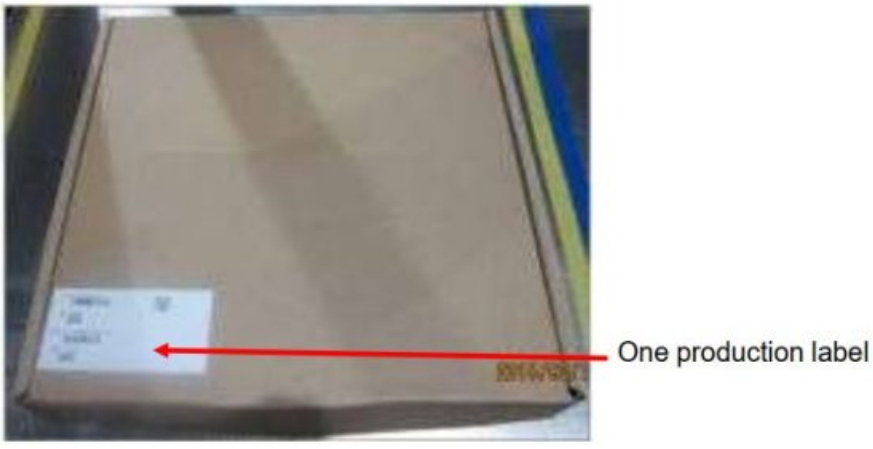


3. One reel is put into the anti-static moisture barrier bag, and then one label is pasted on the bag



4. A bag is put into the anti-static pink bubble wrap

5. A bubble wrap is put into the inner box and then one label is pasted on the inner box



6. 5 inner boxes could be put into one carton

7. Sealing the carton by AzureWave tape

8. One carton label and one box label are pasted on the carton. If one carton is not full, one balance label pasted on the carton

Example of carton label	AzureWave Technologies Inc. AzureWave P/N: AW-HM610 Customer: 由業務提供 Customer P/N: 由業務提供 Customer PO: 由業務提供 Description: AW-XXXXXX QTY: 1200 pcs C/N: N.W.: G.W. RoHS COMPLIANT
Example of box label	BOX0012018

Example of production label	
Example of balance label	

FCC 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.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.
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.
This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

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.

ISED Statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

IC Radiation Exposure Statement:
This equipment complies with IC RSS-102 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.

This module is intended for OEM integrators under the following conditions:

1. Ensure that the end-user has no manual instructions to remove or install module.
2. This module is certified pursuant to Part 15 rules section 15.247 and RSS-247.
3. This module has been approved to operate with the antenna types listed below, with the maximum permissible gain indicated.

Frequency Band	Antenna Type	Brand	Model Number	Gain(dBi)
902-928MHz	Dipole	Cortec	AN0915-5001BSM	2

4. Label and compliance information
Label of the end product:

FCC
The host product must be labeled in a visible area with the following ” Contains FCC ID: TLZ-HM610″.
The end product shall bear the following 15.19 statement: 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.

ISED

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: “Contains IC: 6100A-HM610”.
Contient le module d’émission IC: 6100A-HM610

5. Information on test modes and additional testing requirements

This module has been approved under stand-alone configuration.
The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093/RSS-102 and different antenna configurations
The information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host can be found at KDB Publication 996369 D04. OEM integrator is still responsible for testing their end product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

IMPORTANT NOTE: In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC/ISED authorization is no longer considered valid and the FCC/IC No. cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for reevaluating the end product (including the transmitter) and obtaining a separate FCC/ISED authorization.

6. Additional testing, Part 15 Subpart B and ICES-003 disclaimer
Appropriate measurements (e.g. Part 15 Subpart B compliance) and if applicable additional equipment authorizations (e.g. SDoC) of the host product to be addressed by the integrator/manufacturer.

This module is only FCC/ISED authorized for the specific rule parts 15.247/RSS-247 listed on the grant, and the host product manufacturer is responsible for compliance to any other FCC/ISED rules that apply to the host

product as being Part 15 Subpart B/ICES-003 compliant.

7. The user manual of the end product should include:
FCC:
Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.
The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons.
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.
The antenna(s) used for this transmitter must not transmit simultaneously with any other antenna or transmitter.

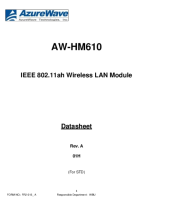
ISED:
This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:
1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

ISED Radiation Exposure Statement:
This equipment complies with IC RSS-102 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 transmitter module may not be co-located with any other transmitter or antenna.

Read More About This Manual & Download PDF:

Documents / Resources

 AW-HM610 IEEE 802.11ah Wireless LAN Module Datasheet	AzureWave AW-HM610 Wireless LAN Module [pdf] Owner's Manual TLZ-HM610, TLZHM610, hm610, AW-HM610 Wireless LAN Module, AW-HM610, Wireless LAN Module, LAN Module

References

- User Manual