

AX8AX9 wifi module manual

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1. Introduction

1.1 overview

AX8AX9 wifi module is a 2T2R 2.4 GHz / 5GHz dual band IEEE802.11 a/b/g/n/ac WLAN module and Low power PCI express (w/ L1 sub-state) interface on Qualcomm QCA6174A-5 chipset. The AX8AX9 wifi module highly integrates MAC, Base band, RF, RF front end.



AX8AX9 wifi module

Figure 1 AX8AX9 wifi module

1.2 Interface

The module includes various different host interfaces to communicate with Host CPU. Below table lists the basic descriptions of the Wi-Fi SoC and the interfaces.

Table 1 MCU and Interfaces

Model		AX8AX9 wifi module
Wi-Fi Technology		IEEE802.11 a/b/g/n/ac
Frequency Band		2.4GHz & 5GHz, Dual Band
Host Interfaces	UART x 1	Up to 3.2Mbps
	USB x 1	USB 1.1
	PCIE x 1	w/ L1 sub-state

1.3 Package Info

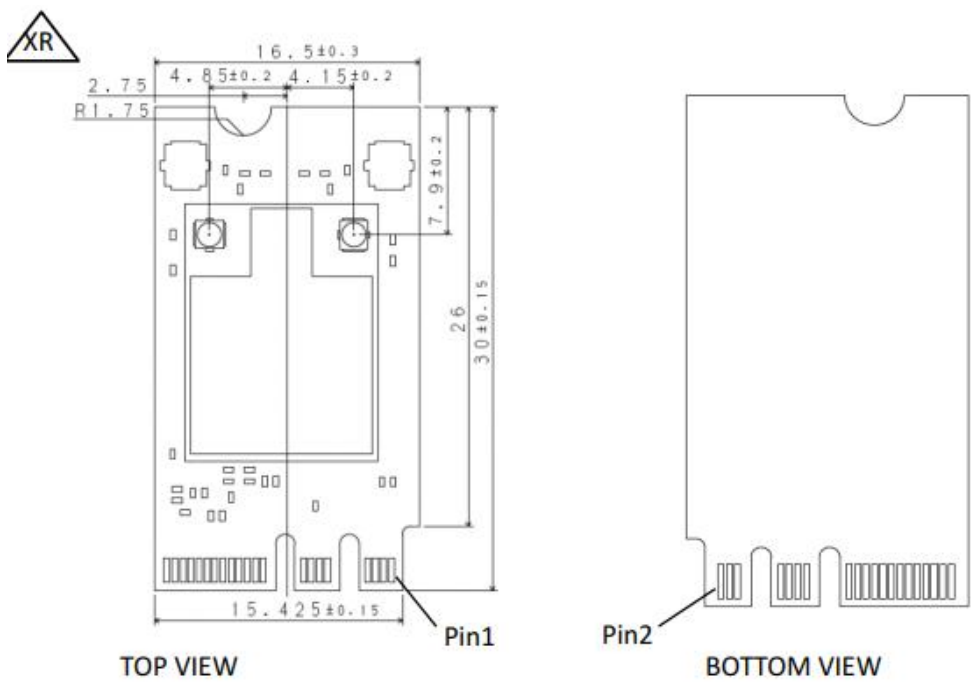


Table 3 Package info

1.4 PIN Description

Table 2 Pin Descriptions

Pin	Pin Name	Type	VDDIO or Pad Voltage	Description
1	GND	GND		
3	USB_D+	AI/AO	–	Bluetooth USB 1.1 differential pair
5	USB_D-	AI/AO	–	Bluetooth USB 1.1 differential pair
7	GND	GND		
17	RESERVED (NC)	NC	NA	NC
19	RESERVED (NC)	NC	NA	NC
21	RESERVED (NC)	NC	NA	NC
23	RESERVED (NC)	NC	NA	NC
33	GND	GND		
35	PETp0#	AI	1.1V	Differential receive from module
37	PETn0#	AI	1.1V	Differential receive from module
39	GND	GND		
41	PERp0#	AO	1.1V	Differential transmit from module
43	PERn0#	AO	1.1V	Differential transmit from module
45	GND	GND		
47	REFCLK+	AI	1.1V	PCIe Differential reference clock (100MHz)
49	REFCLK-	AI	1.1V	PCIe Differential reference clock (100MHz)
51	GND	GND		
53	CLKREQ_L	OD		PCIe Reference clock request. An external pull-up resistor to VDDIO_AO_PM is required.
55	WAKE_L	OD	3.3V	PCIe Request to service a function- initiated wake event. An external pull-up resistor to 3.3V is required.
57	GND	GND		

Pin	Pin Name	Type	VDDIO or Pad Voltage	Description
2	3.3V	POWER	3.3V	3.3V input voltage
4	3.3V	POWER	3.3V	3.3V input voltage
6	RESERVED (NC)	NC	NA	NC
16	RESERVED (NC)	NC	NA	NC
18	GND	GND		
20	RESERVED (NC)	NC	NA	NC
22	RESERVED (NC)	NC	NA	NC
32	RESERVED (NC)	NC	NA	NC
34	RESERVED (NC)	NC	NA	NC
36	RESERVED (NC)	NC	NA	NC
38	RESERVED (NC)	NC	NA	NC
40	RESERVED (NC)	NC	NA	NC
42	RESERVED (NC)	NC	NA	NC
44	RESERVED (NC)	NC	NA	NC
46	RESERVED (NC)	NC	NA	NC
48	RESERVED (NC)	NC	NA	NC
50	RESERVED (NC)	NC	NA	NC
52	PERST_L	PD	3.3V	PCIe reset with weak pull-down
54	RESERVED (NC)	NC	NA	NC
56	RESERVED (NC)	NC	NA	NC

2. Feature Highlights

2.1 Wi-Fi

- WLAN IEEE802.11a/b/g/n/ac, 2.4GHz & 5GHz dual band.
- 2 spatial data stream system (2T2R)
- Flexible country code and channel configuration for worldwide market.
- 2.4 GHz: Support 20/40 MHz bandwidth mode (PHY Data rate 300Mbps, Extra PHY Data rate

400Mbps)

- 5 GHz: Support 20/40/80 MHz bandwidth mode (PHY Data rate 867Mbps)
- Integrated WLAN CMOS power amplifier with internal power detector and closed-loop power control, ensures the high performance on RF sensitivity and stability.

2.2 Security

- AES and TKIP in hardware for faster data encryption
- WEP, WPA and WPA2 support for powerful encryption and authentication

2.3 Network Connection Indication

Indications include:

- AP connecting
- AP connected
- AP disconnected
- Server connecting
- Server connected
- Server disconnected

3. Wi-Fi Specification

3.1 Wireless Specification

Table 3 2.4GHz Wireless Specification

Features		Specification
WLAN Standards		IEEE802.11 b/g/n
Antenna Port		2T2R
Frequency Band	11b	2412-2462 MHz
	11g/n 20MHz	2412-2462 MHz
	11n 40MHz	2422-2452 MHz
Modulation		DSSS(DBPSK,DQPSK,CCK), OFDM(BPSK,QPSK,16-QAM,64-QAM)
Link Data Rate	11b	1,2,5.5L,5.5S,11L,11S
	11g	6,9,12,18,24,36,48,54
	11n	MCS 0,1,2,3,4,5,6,7, 8,9,10,11,12,13,14,15

Table 4 5GHz Wireless Specification

Features	Specification
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WLAN Standards		IEEE802.11 a/n/ac
Antenna Port		2T2R
Frequency Band	11a/n/ac 20MHz	5180-5240MHz, 5260-5320MHz, 5500-5700MHz, 5745-5825MHz
	11n/ac 40MHz	5190-5795MHz, 5270-5310MHz, 5510-5670MHz, 5755MHz,5795MHz
	11ac 80MHz	5210MHz, 5290MHz, 5530MHz, 5775MHz
Modulation		DSSS(DBPSK,DQPSK,CCK), OFDM(BPSK,QPSK,16-QAM,64-QAM,256-QAM)
Support data rates	11a	6,9,12,18,24,36,48,54
	11n	MCS 0,1,2,3,4,5,6,7, 8,9,10,11,12,13,14,15
	11ac	MCS 0,1,2,3,4,5,6,7,8,9

3.2 Tx Power

Table 5 2.4GHz TX Power

RF Characteristics	TYP.			Unit
RF TX Power@11b, 1Mbps	Ch.1-Ch.11			dBm
	16			
RF TX Power@11g,6 Mbps	CH.1	CH.2-10	CH.11	dBm
	16	16	16	
RF TX Power@11g,54 Mbps	CH.1	CH.2-10	CH.11	dBm
	16	16	16	
RF TX Power@11n HT20,MCS0 Mbps	CH.1	CH.2-10	CH.11	dBm
	15	15	15	
RF TX Power@11n HT20,MCS7 Mbps	CH.1	CH.2-10	CH.11	dBm
	15	15	15	
RF TX Power@11n HT40,MCS0 Mbps	CH.3	CH.4-8	CH.9	dBm
	16	16	15	
RF TX Power@11n HT40,MCS7 Mbps	CH.3	CH.4-8	CH.9	dBm
	16	16	15	

Table 6 5GHz TX Power

RF Characteristics	TYP.				Unit
RF TX Power@11a,6 Mbps	Ch.36-Ch.165				dBm
	14				
RF TX Power@11a,54 Mbps	Ch.36-Ch.165				dBm
	14				
RF TX Power@11n/ac 20MHz,MCS0 Mbps	Ch.36-Ch.165				dBm
	14				
RF TX Power@11n/ac 20MHz,MCS8 Mbps	Ch.36-Ch.165				dBm
	14				
RF TX Power@11n/ac 40MHz,MCS0 Mbps	Ch.38	Ch.46-Ch.54	Ch.62	Ch.102-Ch.159	dBm
	13	12	13	13	
RF TX Power@11n/ac 40MHz,MCS8 Mbps	Ch.38-Ch.159				dBm
	12				
RF TX Power@11n/ac 40MHz,MCS9 Mbps	Ch.38-Ch.159				dBm
	12				
RF TX Power@11ac 80MHz,MCS0 Mbps	Ch.42	Ch.58	Ch.106-Ch.155		dBm
	13	11	14		
RF TX Power@11ac 80MHz,MCS9 Mbps	Ch.42-Ch.155				dBm
	11				

3.3 Rx Sensitivity

Table 7 2.4GHz Rx Sensitivity

Receiver Characteristics	TYP.	Unit
PER <8%, Rx Sensitivity @ 1Mbps DSSS	-96	dBm
PER < 8%, Rx Sensitivity @ 11 Mbps CCK	-93	dBm
PER < 10%, Rx Sensitivity @ 6 Mbps OFDM	-90	dBm
PER < 10%, Rx Sensitivity @ 54 Mbps OFDM	-79	dBm
PER < 10%, Rx Sensitivity @ MCS0 11n 20MHz	-90	dBm
PER < 10%, Rx Sensitivity @ MCS7 11n 20MHz	-75	dBm
PER < 10%, Rx Sensitivity @ MCS0 11n 40MHz	-87	dBm
PER < 10%, Rx Sensitivity @ MCS7 11n 40MHz	-73	dBm

Table 8 5GHz Rx Sensitivity

Receiver Characteristics	TYP.	Unit
PER <10%, Rx Sensitivity @ 6Mbps OFDM	-92	dBm
PER < 10%, Rx Sensitivity @ 54 Mbps OFDM	-79	dBm
PER < 10%, Rx Sensitivity @ MCS0 11n/ ac 20MHz	-91	dBm
PER < 10%, Rx Sensitivity @ MCS8 11n/ac 20MHz	-71	dBm
PER < 10%, Rx Sensitivity @MCS0 11n/ac 40MHz	-88	dBm
PER < 10%, Rx Sensitivity @ MCS7 11n/ac 40MHz	-73	dBm
PER < 10%, Rx Sensitivity @ MCS9 11n/ac 40MHz	-67	dBm
PER < 10%, Rx Sensitivity @ MCS0 11ac 80MHz	-85	dBm
PER < 10%, Rx Sensitivity @ MCS7 11ac 80MHz	-65	dBm

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

2.2 List of applicable FCC rules

FCC Part 15 Subpart C 15.247 & 15.209 & 15.407.

2.3 Specific operational use conditions

The module can be used for mobile applications with a maximum 4.56dBi antenna. The host manufacturer installing this module into their product must ensure that the final product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation. The host manufacturer has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as shown in this manual.

2.4 Limited module procedures

Not applicable. The module is a Single module and complies with the requirement of FCC Part 15.212.

2.5 Trace antenna designs

Not applicable. The module has its own antenna, and doesn't need a host. printed board microstrip trace antenna etc.

2.6 RF exposure considerations

The module must be installed in the host equipment such that at least 20cm is maintained between the antenna and users' body; and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for reevaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

2.7 Antennas

Antenna Specification are as follows: Type: FPC Antenna Gain: 4.56dBi Max. This device is intended only for host manufacturers under the following conditions: The transmitter module may not be co-located with any other transmitter or antenna; The module shall be only used with the internal antenna(s) that has been originally tested and certified with this module. The antenna must be either permanently attached or employ a „unique“ antenna coupler. As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer 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.).

2.8 Label and compliance information

Host product manufacturers need to provide a physical or e-label stating “Contains **FCC ID: SMQAX8AX9** ” with their finished product

2.9 Information on test modes and additional testing requirements

Host manufacturer must perform test of radiated & conducted emission and spurious emission, e.t.c according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product. Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247 & 15.209 & 15.407 and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Federal Communication Commission Statement (FCC, U.S.)

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 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.

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.

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.

IMPORTANT NOTES

Co-location warning:

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

OEM integration instructions:

This device is intended only for OEM integrators under the following conditions: The transmitter module may not be co-located with any other transmitter or antenna. The module shall be only used with the external antenna(s) that has been originally tested and certified with this module. As long as the conditions above are met, further transmitter test will not be required. However, the 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.).

Validity of using the module certification:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination

with the host equipment is no longer considered valid and the FCC ID of the module cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End product labeling:

The final end product must be labeled in a visible area with the following: “Contains Transmitter Module **FCC ID: SMQAX8AX9** ”.

Information that must be placed in the end user manual:

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.