

**NW-121**  
**QCA9880**  
**3x3 11ac/n/g/b/a**  
**2.4/5GHz Wi-Fi module**

**產品規格書**  
**Product Specification Document**

**Rev 1.8**  
**June 23<sup>rd</sup>, 2016**

## 1 Revision History

Project Name		NW-121	Document No.	
Revision		Date	Release Notes	
From	To			
	V1.0	2015/05/29	Initial release	
V1.0	V1.1	2015/06/22	Page3, update operating frequency Page5, add missing HT40 MCS7 value under 2.4G Tx power Page6~8, update CH information under 5GHz	
V1.1	V1.2	2015/10/28	Correct model name	
V1.2	V1.3	2015/10/29	Page 3, update 11n/11ac data rate Page 3~4, update 11n/11ac modulation	
V1.3	V1.4	2015/12/15	Page 3, add not to support DFS frequencies per different country's regulations.	
V1.4	V1.5	2015/12/29	Page 10, remove block diagram. Page 13, add antenna information	
V1.5	V1.6	2016/04/21	Page 3. Add to support DFS frequencies	
V1.6	V1.7	2016/06/13	Generic version	
V1.7	V1.8	2016/06/23	Page 3, Correct item 3.4 to support DFS Page 3, Correct operation frequency to be up to 2.462GHz Page 14~16, Add Statements for FCC/IC	

## 2 Introduction

NW-121 is a 3x3 11ac/n/b/g/a 2.4/5GHz dual-band WiFi module. It is based on Qualcomm Atheros QCA9880 chip solution. This module uses 3x3 multiple input/multiple output (MIMO), Orthogonal Frequency Division Multiplexing (OFDM) and Direct Sequence Spread Spectrum (DSSS) communication techniques. QCA9880 provides wireless data communications at rates of up to 1.3Gbps, depending on the coding techniques employed and the range of the system.

## 3 Functions:

- 3.1 IEEE standard supports 802.11ac/n/g/b/a
- 3.2 Support 20/40/80MHz bandwidth with 256QAM modulation
- 3.3 Spatial multiplexing up to 1.3Gbps data rate by 3T3R.
- 3.4 Support DFS frequencies per different country's regulations.
- 3.5 RoHS compliant

## 4 Hardware Specifications:

Chipset Vendor	Qualcomm Atheros
Chipset model name	QCA9880
Antenna	3 x I-PEX connectors, 3T3R
Host Interface	PCI-Express
Form Factor	Mini-PCle (Full Mini-Card)
Wireless LAN Standards	IEEE 802.11ac/n/b/g/a
Operating Frequency	2.412 GHz ~2.462 GHz 5.18 GHz~5.825 GHz (with DFS support)
Operating Voltage	3.3V
WLAN Data Rate	
802.11a/g	54Mbps with fall back of 48, 36, 24, 18, 12, 9, 6 Mbps
802.11b	11Mbps with fall back rates of 5.5, 2, and 1 Mbps
802.11n	HT MCS0~MCS23 (450Mbps)
802.11ac	VHT MCS0~MCS9 (1300Mbps)
Modulation Schemes	
802.11a/g	64QAM (54 Mbps, 48 Mbps), 16QAM (36 Mbps, 24Mbps), QPSK (18 Mbps, 12 Mbps), BPSK (9 Mbps, 6 Mbps)
802.11b	CCK (11 Mbps, 5.5 Mbps), DQPSK (2 Mbps), DBPSK (1 Mbps)

802.11n	HT MCS0/8/16: BPSK, R=1/2; HT MCS1/9/17: QPSK, R=1/2; HT MCS2/10/18: QPSK, R=3/4; HT MCS3/11/19: 16QAM, R=1/2; HT MCS4/12/20: 16QAM, R=3/4; HT MCS5/13/21: 64QAM, R=2/3; HT MCS6/14/22: 64QAM, R=3/4; HT MCS7/15/23: 64QAM, R=5/6.
802.11ac	VHT MCS0: BPSK, R=1/2; VHT MCS1: QPSK, R=1/2; VHT MCS2: QPSK, R=3/4; VHT MCS3: 16QAM, R=1/2; VHT MCS4: 16QAM, R=3/4; VHT MCS5: 64QAM, R=2/3; VHT MCS6: 64QAM, R=3/4; VHT MCS7: 64QAM, R=5/6. VHT MCS8: 256QAM, R=3/4; VHT MCS9: 256QAM, R=5/6

#### 4.1 2.4GHz TX Power (dBm)

20MHz BW	CH1	CH6	CH13
1Mbps	18	18	18
2Mbps	18	18	18
5.5Mbps	18	18	18
11Mbps	18	18	18
6Mbps	19	19	19
9Mbps	19	19	19
12Mbps	19	19	19
18Mbps	19	19	19
24Mbps	19	19	19
36Mbps	17.5	17.5	17.5
48Mbps	16.5	16.5	16.5
54Mbps	15	15	15
HT20 MCS0	19	19	19
HT20 MCS1	19	19	19
HT20 MCS2	19	19	19
HT20 MCS3	18	18	18
HT20 MCS4	18	18	18

HT20 MCS5	17	17	17
HT20 MCS6	15	15	15
HT20 MCS7	13	13	13

40MHz BW	CH3	CH6	Ch11
HT40 MCS0	18	18	18
HT40 MCS1	18	18	18
HT40 MCS2	18	18	18
HT40 MCS3	17	17	17
HT40 MCS4	17	17	17
HT40 MCS5	17	17	17
HT40 MCS6	13	13	13
HT40 MCS7	10	10	10

## 4.2 2.4GHz RX Sensitivity (dBm)

20MHz BW	CH1	CH6	CH13
6Mbps	-90	-90	-90
9Mbps	-90	-90	-90
12Mbps	-90	-90	-90
18Mbps	-88	-88	-88
24Mbps	-84	-84	-84
36Mbps	-80	-80	-80
48Mbps	-76	-76	-76
54Mbps	-76	-76	-74
HT20 MCS0	-90	-90	-90
HT20 MCS1	-90	-90	-90
HT20 MCS2	-88	-88	-88
HT20 MCS3	-82	-82	-82
HT20 MCS4	-80	-80	-80
HT20 MCS5	-74	-76	-76
HT20 MCS6	-74	-74	-74
HT20 MCS7	-72	-72	-72

40MHz BW	CH3	CH6	Ch11
HT40 MCS0	-86	-88	-88

HT40 MCS1	-86	-86	-86
HT40 MCS2	-84	-84	-84
HT40 MCS3	-78	-80	-80
HT40 MCS4	-76	-76	-76
HT40 MCS5	-72	-72	-72
HT40 MCS6	-72	-72	-72
HT40 MCS7	-70	-70	-70

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### 4.3 5GHz TX Power (dBm)

20MHz BW	CH36	CH100	CH140
6Mbps	18	18	18
9Mbps	18	18	18
12Mbps	18	18	18
18Mbps	18	18	18
24Mbps	18	18	18
36Mbps	15.5	15.5	15.5
48Mbps	15	15	15
54Mbps	14	14	14
HT20 MCS0	18	18	18
HT20 MCS1	18	18	18
HT20 MCS2	18	18	18
HT20 MCS3	16	16	16
HT20 MCS4	16	16	16
HT20 MCS5	14	14	14
HT20 MCS6	13	13	13
HT20 MCS7	13	13	13
VHT20 MCS8	13	13	13

40MHz BW	CH36	CH100	CH140
HT40 MCS0	18	18	18
HT40 MCS1	18	18	18
HT40 MCS2	18	18	18
HT40 MCS3	16	16	16
HT40 MCS4	16	16	16
HT40 MCS5	14	14	14
HT40 MCS6	13	13	13
HT40 MCS7	13	13	13
VHT40 MCS8	13	13	13
VHT40 MCS9	12	12	12

80MHz BW	CH36	CH100	CH140
VHT80 MCS0	18	18	18

VHT80 MCS1	18	18	18
VHT80 MCS2	18	18	18
VHT80 MCS3	15	15	15
VHT80 MCS4	15	15	15
VHT80 MCS5	13	13	13
VHT80 MCS6	12	12	12
VHT80 MCS7	12	12	12
VHT80 MCS8	11	11	11
VHT80 MCS9	11	11	11

#### 4.4 5GHz RX Sensitivity (dBm)

20MHz BW	CH36	CH100	CH140
6Mbps	-92	-92	-92
9Mbps	-92	-92	-92
12Mbps	-92	-90	-90
18Mbps	-88	-88	-88
24Mbps	-86	-84	-84
36Mbps	-80	-80	-80
48Mbps	-76	-76	-76
54Mbps	-76	-74	-74
HT20 MCS0	-94	-92	-92
HT20 MCS1	-90	-90	-90
HT20 MCS2	-88	-88	-86
HT20 MCS3	-84	-82	-82
HT20 MCS4	-80	-78	-78
HT20 MCS5	-76	-72	-72
HT20 MCS6	-74	-72	-72
HT20 MCS7	-72	-70	-70
VHT20 MCS8	-70	-68	-66

40MHz BW	CH36	CH100	CH140
HT40 MCS0	-94	-92	-92
HT40 MCS1	-92	-90	-90
HT40 MCS2	-88	-88	-86
HT40 MCS3	-84	-82	-82



HT40 MCS4	-80	-78	-78
HT40 MCS5	-76	-74	-72
HT40 MCS6	-74	-72	-72
HT40 MCS7	-72	-70	-68
VHT40 MCS8	-66	-66	-66
VHT40 MCS9	-62	-62	-62

80MHz BW	CH36	CH100	CH140
VHT80 MCS0	-88	-86	-86
VHT80 MCS1	-86	-84	-84
VHT80 MCS2	-82	-80	-80
VHT80 MCS3	-78	-76	-76
VHT80 MCS4	-74	-74	-72
VHT80 MCS5	-70	-70	-68
VHT80 MCS6	-68	-68	-68
VHT80 MCS7	-68	-66	-66
VHT80 MCS8	-62	-62	-62
VHT80 MCS9	-60	-60	-60

## 5 Connector Pin-out:

Pin#	Pin Name	Description	Pin#	Pin Name	Description
1	WAKE_L(NA)	Output and open Drain active Low signal. This signal is used to request that the system return from a sleep/suspended state to service a function initiated wake event.	2	+3.3V	+3.3V
3	No Connection	-	4	GND	GND
5	No Connection	-	6	No Connection	-
7	CLKREQ_L	Output for reference clock request signal	8	No Connection	-
9	GND	GND	10	No Connection	-
11	REFCLK-	Input signal for PCI Express differential reference clock (100MHz)	12	No Connection	-
13	REFCLK+	Input signal for PCI Express differential reference clock (100MHz)	14	No Connection	-
15	GND	GND	16	No Connection	-
17	No Connection	-	18	GND	GND
19	No Connection	-	20	W_DISABLE_L	Input and active low signal. This signal is used by the system to disable radio operation on add-in cards that implement radio frequency applications. When implemented, this signal requires a pull-up resistor on the card
21	GND	GND	22	PERST_L	Input signal for functional reset to the card

23	PERn0	PCI Express x1 data interface: one differential receive pair	24	+3.3V	+3.3V
25	PERp0	PCI Express x1 data interface: one differential receive pair	26	GND	GND
27	GND	GND	28	No Connection	-
29	GND	GND	30	No Connection	-
31	PETn0	PCI Express x1 data interface: one differential transmit pair	32	No Connection	-
33	PETp0	PCI Express x1 data interface: one differential transmit pair	34	GND	GND
35	GND	GND	36	No Connection	-
37	GND	GND	38	No Connection	-
39	No Connection	-	40	GND	GND
41	No Connection	-	42	No Connection	-
43	GND	GND	44	LED_WLAN_L (OPT)	Output and open drain active low signal. This signal is used to allow the PCI Express Mini Card add-in card to provide status indicators via LED devices that will be provided by the system
45	No Connection	-	46	No Connection	-
47	No Connection	-	48	No Connection	-
49	No Connection	-	50	GND	GND
51	No Connection	-	52	+3.3V	+3.3V

## 6 Environmental Requirements:

### 6.1 Temperature

#### 6.1.1 Operating Temperature Conditions

The product shall be capable of continuous reliable operation when operating in ambient temperature of 0 to +50 degree C.

#### 6.1.2 Non-Operating Temperature Conditions

Neither subassemblies shall be damaged nor shall the operational performance be degraded when restored to the operating temperature when exposed to storage temperature in the range of -20 to +80 degree C

### 6.2 Humidity

#### 6.2.1 Operating Humidity Conditions

The product shall be capable of continuous reliable operation when subjected to relative humidity in the range of 15% and 90% non-condensing.

#### 6.2.2 Non-Operating Humidity conditions

The product shall not be damaged nor shall the performance be degraded after exposure to relative humidity ranging from 0% to 95% non-condensing

## 7 Product Photo:



## 8 Antenna information

This device is intended only for OEM integrators under the following conditions:

- 8.1 The antenna must be installed such that 20 cm is maintained between the antenna and users, and the maximum antenna gain allowed for use with this device is 2 dBi.
- 8.2 The transmitter module may not be co-located with any other transmitter or antenna
- 8.3 Proposed antenna vendor information

Antenna type	Manufacturer	Model	Gain
Dipole	WIESON Technologies	GY121L049S-XXX	2dBi
PIFA	Aristotle	RFA-25-AP250-70-XXX	2dBi

## 9 Statements:

### 9.1 Federal Communication 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 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.

#### **FCC Radiation Exposure Statement:**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter.

This End equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

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**IMPORTANT NOTE:**

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not 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 FCC ID: YHI-NW121”.

**Manual Information to the End User**

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.

## 9.2 Canada Statement

This device complies with Industry Canada’s licence-exempt RSSs.

Operation is subject to the following two conditions:

- (1) This device may not cause interference; and
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d’Industrie Canada applicables aux appareils radio exempts de licence. L’exploitation est autorisée aux deux conditions suivantes :

- (1) l’appareil ne doit pas produire de brouillage;
- (2) l’utilisateur de l’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.

**Caution Exposure:**

This device meets the exemption from the routine evaluation limits in section 2.5 of RSS102 and users can obtain Canadian information on RF exposure and compliance.

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Le dispositif répond à l'exemption des limites d'évaluation de routine dans la section 2.5 de RSS102 et les utilisateurs peuvent obtenir des renseignements canadiens sur l'exposition aux RF et le respect.

**The final end product must be labelled in a visible area with the following:**

The Industry Canada certification label of a module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labelled to display the Industry Canada certification number of the module, preceded by the words "Contains transmitter module", or the word "Contains", or similar wording expressing the same meaning, as follows:

Contains transmitter module IC: 9715A-NW121

The module must be installed in **L-71W**.

This End equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

Cet équipement devrait être installé et actionné avec une distance minimum de 20 centimètres entre le radiateur et votre corps.

The end user manual shall include all required regulatory information/warning as show in this manual.