NW-111
AR9580
3x3 11n/g/b/a
2.4/5GHz Wi-Fi module

產品規格書
Product Specification Document

Rev 1.5

December 30, 2015

1 Revision History

Project Name			NW-111	Document No.	
Revision		Date	Release Notes		
From	To				
	V1.0	2015/06/22	Initial release		
V1.0	V1.1	2015/10/28	Correct model name		
V1.1	V1.2	2015/10/29	Page 3, update 11n data rate Page 3~4, update 11n modulation		
V1.2	V1.3	2015/11/03	Page 8, Update block diagram		
V1.3	V1.4	2015/12/15	Page 3, add not to support DFS frequencies per different country's regulations.		
V1.4	V1.5	2015/12/30	Page 8, remove block diagram. Page 11, add antenna information		

2 Introduction

NW-111 is a 3x3 11n/b/g/a 2.4/5GHz dual-band WiFi module. It is based on Qualcomm Atheros AR9580 chip solution. This module uses 3x3 multiple input/multiple output (MIMO), Orthogonal Frequency Division Multiplexing (OFDM) and Direct Sequence Spread Spectrum (DSSS) communication techniques. AR9580 provides wireless data communications at rates of up to 450Mbps, depending on the coding techniques employed and the range of the system.

3 Functions:

3.1 IEEE standard supports 802.11n/g/b/a
3.2 Support 20/40MHz bandwidth with 64QAM modulation
3.3 Spatial multiplexing up to 450Mbps data rate by 3T3R.
3.4 Doesn't support DFS frequencies per different country's regulations.
3.5 RoHS compliant

4 Hardware Specifications:

Chipset Vendor	Qualcomm Atheros
Chipset model name	AR9580
Antenna	3 x I-PEX connectors, 3T3R
Host Interface	PCI-Express
Form Factor	Mini-PCIe (Full Mini-Card)
Wireless LAN Standards	IEEE 802.11n/b/g/a
Operating Frequency	2.412 GHz ~2.472 GHz 5.18 GHz~5.825 GHz (Doesn't support DFS frequencies per different country's regulations)
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)
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.

4.1 2.4GHz TX Power (dBm)

20MHz BW	CH1	CH6	CH13
1Mbps	19	19	19
2Mbps	19	19	19
5.5Mbps	19	19	19
11Mbps	19	19	19
6Mbps	19	19	19
9Mbps	19	19	19
12Mbps	19	19	19
18Mbps	19	19	19
24Mbps	19	19	19
36Mbps	19	19	19
48Mbps	17	17	17
54Mbps	15	15	15
HT20 MCS0	18	18	18
HT20 MCS1	18	18	18
HT20 MCS2	18	18	18
HT20 MCS3	18	18	18
HT20 MCS4	18	18	18
HT20 MCS5	17	17	17
HT20 MCS6	16	16	16
HT20 MCS7	14	14	14

40MHz BW	CH3	CH6	Ch11
HT40 MCS0	17	17	17
HT40 MCS1	17	17	17
HT40 MCS2	17	17	17
HT40 MCS3	17	17	17

HT40 MCS4	17	17	17
HT40 MCS5	17	17	17
HT40 MCS6	15	15	15
HT40 MCS7	12	12	12

4.2 2.4GHz RX Sensitivity (dBm)

20MHz BW	CH1	CH6	CH13
6Mbps	-88	-88	-86
9Mbps	-88	-88	-86
12Mbps	-88	-88	-86
18Mbps	-88	-88	-86
24Mbps	-86	-84	-84
36Mbps	-82	-82	-80
48Mbps	-78	-76	-76
54Mbps	-76	-74	-74
HT20 MCS0	-90	-88	-88
HT20 MCS1	-90	-88	-88
HT20 MCS2	-88	-86	-86
HT20 MCS3	-84	-84	-84
HT20 MCS4	-80	-80	-80
HT20 MCS5	-76	-74	-74
HT20 MCS6	-74	-74	-72
HT20 MCS7	-72	-72	-70

40MHz BW	CH3	CH6	Ch11
HT40 MCS0	-86	-86	-86
HT40 MCS1	-86	-84	-84
HT40 MCS2	-84	-82	-84
HT40 MCS3	-80	-78	-80
HT40 MCS4	-76	-74	-76
HT40 MCS5	-72	-72	-72
HT40 MCS6	-70	-70	-72
HT40 MCS7	-68	-68	-68

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	17	17	17
48Mbps	15	15	15
54Mbps	13	13	13
HT20 MCS0	18	18	18
HT20 MCS1	18	18	18
HT20 MCS2	18	18	18
HT20 MCS3	18	18	18
HT20 MCS4	17	17	17
HT20 MCS5	15	15	15
HT20 MCS6	14	14	14
HT20 MCS7	13	13	13

40MHz BW	CH36	CH100	CH140
HT40 MCS0	17	17	17
HT40 MCS1	17	17	17
HT40 MCS2	17	17	17
HT40 MCS3	17	17	17
HT40 MCS4	17	17	17
HT40 MCS5	15	15	15
HT40 MCS6	13	13	13
HT40 MCS7	12	12	12

4.4 5GHz RX Sensitivity (dBm)

20MHz BW	CH36	CH100	CH140
6Mbps	-93	-93	-93
9Mbps	-92	-92	-92

12Mbps	-90	-90	-90
18Mbps	-88	-88	-88
24Mbps	-84	-84	-84
36Mbps	-82	-82	-80
48Mbps	-78	-78	-76
54Mbps	-76	-76	-74
HT20 MCS0	-94	-94	-92
HT20 MCS1	-90	-90	-88
HT20 MCS2	-88	-88	-86
HT20 MCS3	-84	-82	-82
HT20 MCS4	-80	-80	-78
HT20 MCS5	-76	-76	-74
HT20 MCS6	-74	-74	-72
HT20 MCS7	-72	-72	-70

40MHz BW	**CH36**	**CH100**	**CH140**
HT40 MCS0	-90	-90	-90
HT40 MCS1	-86	-86	-86
HT40 MCS2	-84	-84	-84
HT40 MCS3	-80	-80	-78
HT40 MCS4	-76	-76	-76
HT40 MCS5	-72	-72	-72
HT40 MCS6	-72	-70	-70
HT40 MCS7	-68	-70	-68

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

Federal Communication Commission Interference 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.

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

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.

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

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.
2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 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

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

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 FCC ID: YHI-NW111**". The grantee's FCC ID can be used only when all FCC compliance requirements are met.

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

Industry Canada statement

❶ This device complies with Industry Canada license-exempt RSS standard(s). 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.

❶ 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, et
2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

❷ This Class B digital apparatus complies with Canadian ICES-003.

❷ Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

Radiation Exposure Statement:

This equipment complies with IC 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.

Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

Caution :

(i) the device for operation in the band 5150-5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems;
(ii) the maximum antenna gain permitted for devices in the band 5725-5850 MHz shall be such that the equipment still complies with the e.i.r.p. limits specified for point-to-point and non-point-to-point operation as appropriate; and
(iii) Users should also be advised that high-power radars are allocated as primary users (i.e. priority users) of the bands 5650-5850 MHz and that these radars could cause interference and/or damage to LE-LAN devices.

Avertissement:

(i) les dispositifs fonctionnant dans la bande 5150-5250 MHz sont réservés uniquement pour une utilisation à l’intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux;
(ii) le gain maximal d'antenne permis (pour les dispositifs utilisant la bande de 5725 à 5 850 MHz) doit être conforme à la limite de la p.i.r.e. spécifiée pour l'exploitation point à point et l’exploitation non point à point, selon le cas;

(iii) De plus, les utilisateurs devraient aussi être avisés que les utilisateurs de radars de haute puissance sont désignés utilisateurs principaux (c.-à-d., qu'ils ont la priorité) pour les bandes 5650-5850 MHz et que ces radars pourraient causer du brouillage et/ou des dommages aux dispositifs LAN-EL.

This device is intended only for OEM integrators under the following conditions: (For module device use)
1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2) The transmitter module may not be co-located with any other transmitter or antenna.
As long as 2 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.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: (Pour utilisation de dispositif module)
1) L'antenne doit être installée de telle sorte qu'une distance de 20 cm est respectée entre l'antenne et les utilisateurs, et
2) Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.
Tant que les 2 conditions ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

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 Canada authorization is no longer considered valid and the IC 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 Canada authorization.

NOTE IMPORTANTE:
Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

End Product Labeling
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:9715A-NW111".

Plaque signalétique du produit final
Ce module émetteur est autorisé uniquement pour une utilisation dans un dispositif où l'antenne peut être installée de telle sorte qu'une distance de 20cm peut être maintenue entre l'antenne et les utilisateurs. Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC:

9715A-NW111".

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

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module. Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.