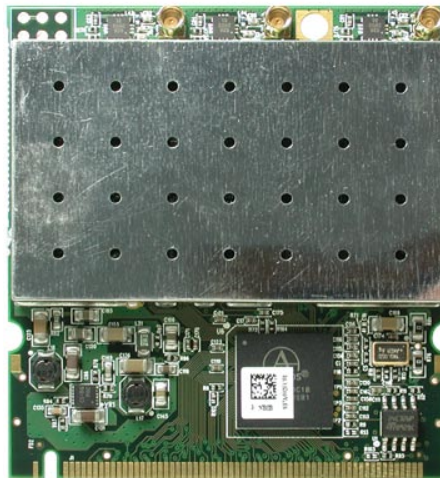
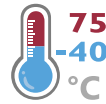




# DNMA-H5 Information Sheet

Industrial-grade, high-power 802.11n a/b/g wifi 3x3 mini-PCI module w/ESD and Surge Protection, AR9160-BC1B+AR9106



## Overview:

DNMA-H5 is an industrial-grade, high-power 802.11n a/b/g wifi 3x3 mini-PCI module designed specifically to enable highest performance, reliability, and durability in the harshest temperature range of  $-40^{\circ}\text{C} \sim +75^{\circ}\text{C}$ .

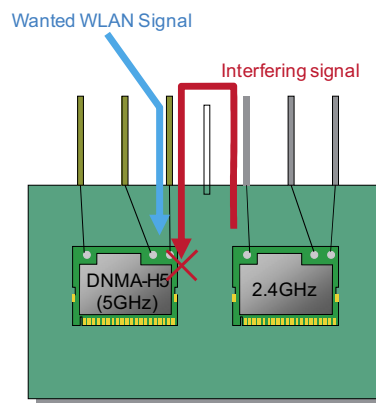
Unique Rx filter design and power control accuracy in  $-40^{\circ}\text{C} \sim +75^{\circ}\text{C}$  temperature range can dramatically reduce wifi interference to improve the data throughput and range performance in con-current 2.4 & 5GHz applications and high-density outdoor hot-spot deployments.

RF ESD/ Surge protection up to 10KV ensures highest levels of performance and reliability in the harshest outdoor environment such as mesh networking, military, bridging, and infrastructure applications.

Atheros AR9160-BC1B industrial grade chipset supports 2 simultaneous traffic MIMO streams using up to 3 integrated Tx and Rx for high throughput and range performance.

## Key Features:

- » Extra Rx filter provides the excellent radio rejection against the interfering signal from the 2nd WiFi module on con-current 2.4 & 5GHz (dual band dual con-current, DBDC) application to dramatically improve the data throughput/ range performance.



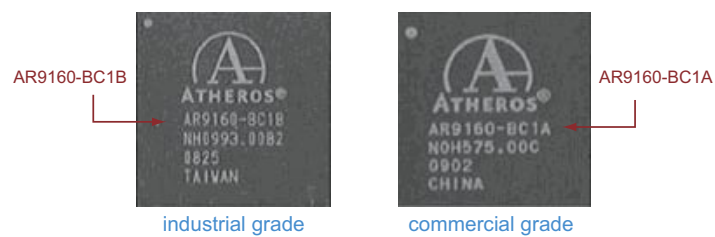
One DNMA-H5 and one 2.4GHz wifi module can work simultaneously (dual band dual con-current, DBDC) in the same platform under different frequency band, DNMA-H5 in 5GHz and the other WiFi module in 2.4GHz, without Rx sensitivity degradation.

- » RF ESD and Surge protection up to 10KV ensure highest levels of performance and reliability in the harshest outdoor mesh or military deployments.
- » Industrial grade AR9160-BC1B chipset ensures reliability and durability in  $-40^{\circ}\text{C} \sim +75^{\circ}\text{C}$  range for rugged devices.
- » High RF power up to 400mW (26dBm) @ 5GHz and 600mW (28dBm) @ 2.4GHz provides superior wifi coverage.
- » PA fine-tuning gains balance of linearity and power consumption with enough margin while maintaining adequate Tx power to ensure no major performance degradation over time.
- » 3~5dBi Tx linearity improvement than standard MB82 reference design.
- » Same EVM on both light and heavy loading maintain lower packet error to increase channel efficiency.
- » 3.3Vdc+5.0Vdc dual power supply design (5Vdc from mini-PCI interface pin18 & pin 97 per mini-PCI standard) enables high power application in limited PCB size.
- » Mini-PCI Type IIIA form factor (length is 15mm longer than IIIA type) with screw hole is ideal for solid mounting onto motherboard.
- » Dual band 802.11 a/b/g/n support 3Tx/3Rx to enable data rate up to 300Mbps link rate for 40MHz channel,

six times the throughput of 802.11a and 802.11g.

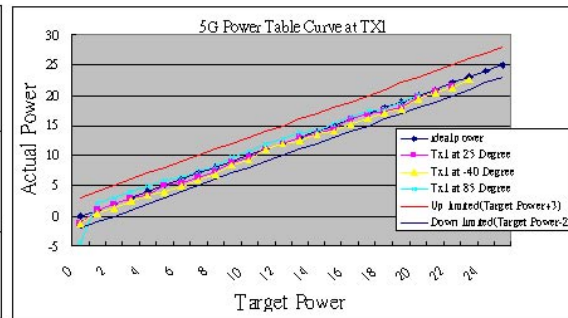
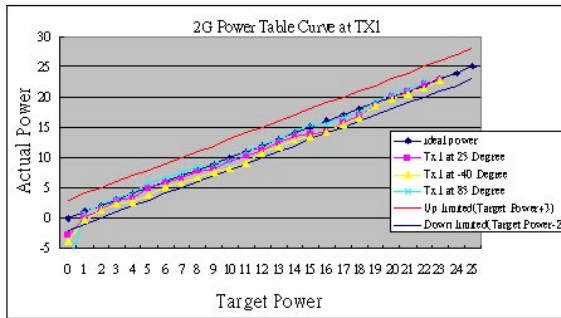
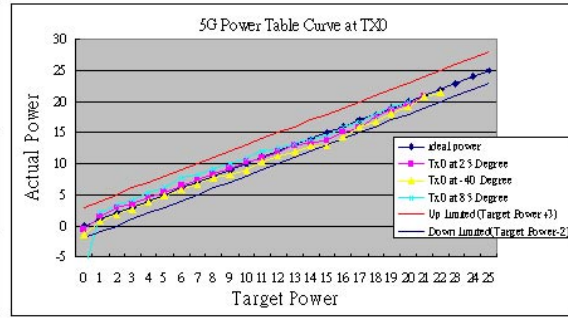
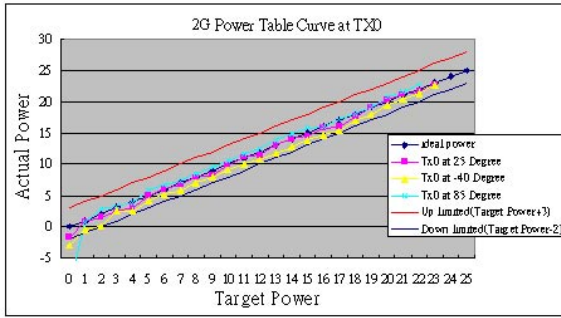
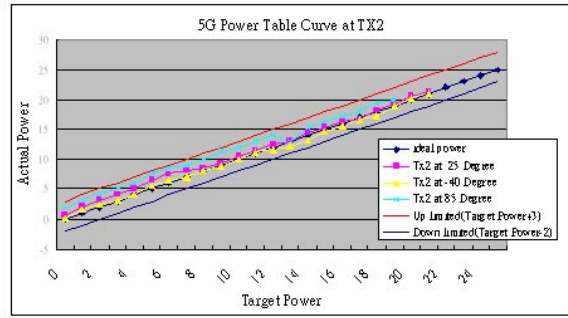
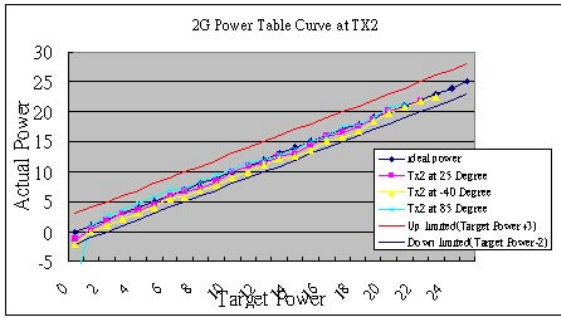
- » Supported by ath9k and FreeBSD providing Linux kernel driver for industrial, academic, or personal projects at highest flexibility and lowest cost.
- » Atheros Linux SDK for AP and client-mode sub-license available by project.
- » Supports 64/128/152-bit WEP encryption, IEEE 802.1x authentication, and AES & TKIP encryption.
- » Heat sink design provides reliable high power RF performance.
- » Three DIP type MMCX RF connector enables robust assembly and lower loss for external antenna.
- » REACH and RoHS compliance meets environment-friendly requirement.

## Why AR9160-BC1B industrial grade chipset required?

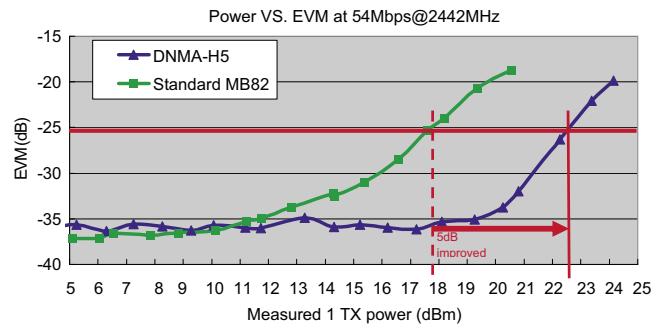
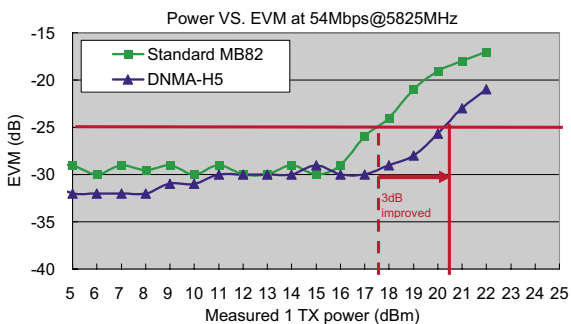


Industrial grade AR9160-BC1B chipset is for applications in the most-demanding environments in the world. It must withstand tremendous temperature, humidity, and ambient air ranges. By contrast, the commercial grade AR9160-BC1A is for applications generally placed in a climate-controlled environment that is carefully monitored to ensure optimum performance.

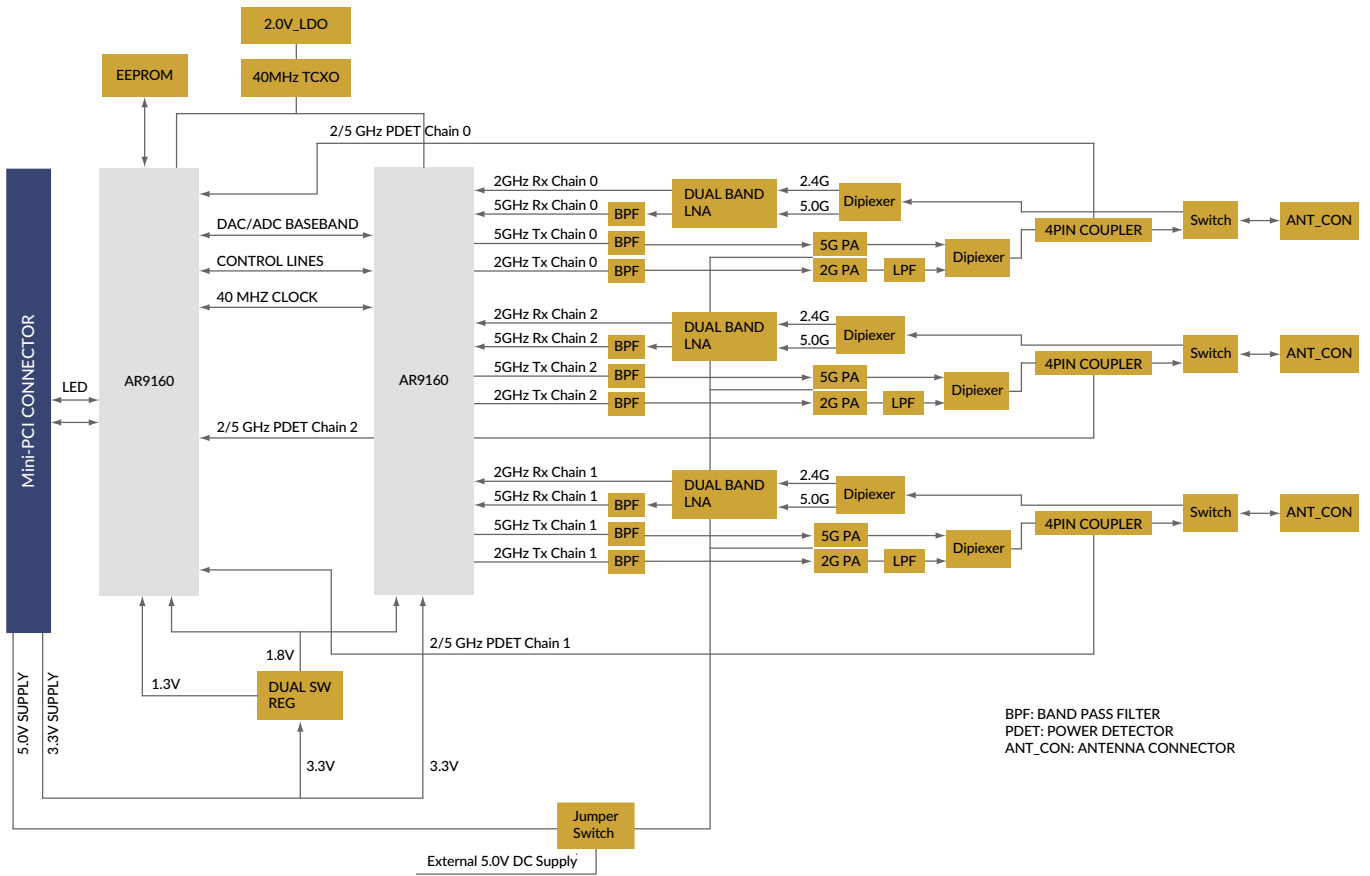
Power control accuracy reaches 1dBm in temperature range -40~ +75°C which dramatically improves the data throughput and range performance in high-density enterprise and commercial hot-spot deployments with high-gain antenna.



## Tx power improvement than standard MB82 reference design

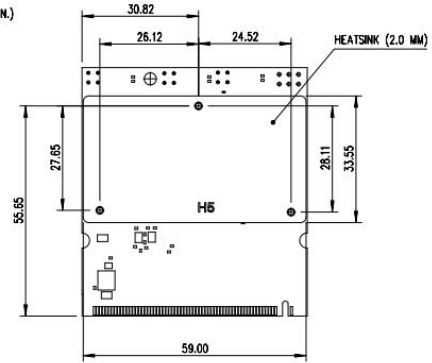
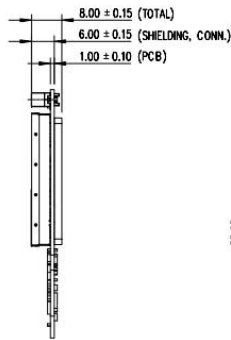
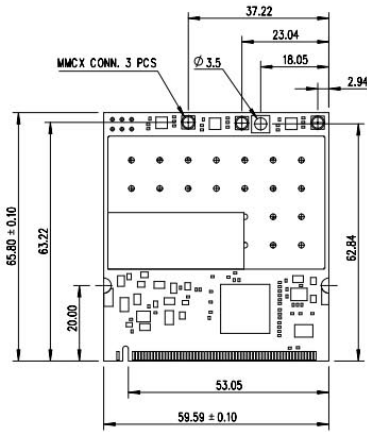
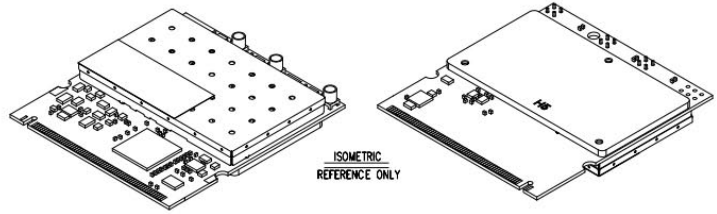


# Hardware Block Diagram:



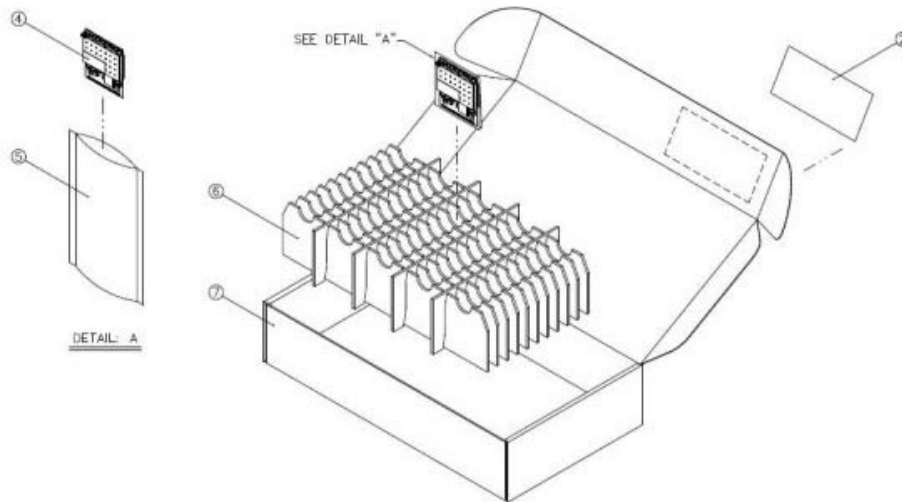
# Mechanical Outline:

Unit: mm

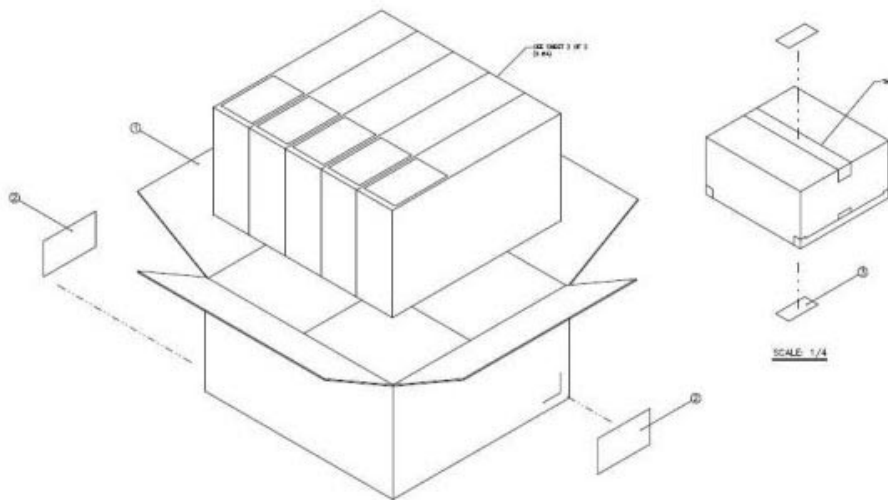


# Packing Standard:

Packing box: 50 pcs/box



Carton: 5 packing box/carton = 250 pcs/carton



# Specifications:

Chipset	Atheros AR9160-BC1B+AR9106
Standard Conformance	802.11a, 802.11b, 802.11g, and 802.11n
Frequency Range	<ul style="list-style-type: none"><li>» USA: 2.400 ~ 2.483GHz, 5.15 ~ 5.35GHz, 5.5 ~ 5.7GHz, 5.725 ~ 5.825GHz</li><li>» Europe: 2.400 ~ 2.483GHz, 5.15 ~ 5.35GHz, 5.47 ~ 5.725GHz</li><li>» Japan: 2.400 ~ 2.497GHz, 5.15 ~ 5.35GHz, 5.47 ~ 5.725GHz</li><li>» China: 2.400 ~ 2.483GHz, 5.725 ~ 5.85GHz</li></ul>
Interface	32-bit mini-PCI Type III A (15mm longer than III A type)
Operation Voltage	3.3V plus 5.0V $\pm$ 5% (5V is only for PA in high power application)
Modulation Technique	<ul style="list-style-type: none"><li>» DSSS with CCK, DQPSK, DBPSK</li><li>» OFDM with BPSK, QPSK, 16QAM, 64QAM</li></ul>
Data Rate	<ul style="list-style-type: none"><li>» 802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps</li><li>» 802.11b: 1, 2, 5.5 and 11Mbps</li><li>» 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps</li><li>» 802.11n:<ul style="list-style-type: none"><li>» 20MHz channel:<ul style="list-style-type: none"><li>» 1Nss: 65Mbps @ 800GI, 72.2Mbps @ 400GI (Max.)</li><li>» 2Nss: 130Mbps @ 800GI, 144.4Mbps @ 400GI (Max.)</li></ul></li><li>» 40MHz channel:<ul style="list-style-type: none"><li>» 1Nss: 135Mbps @ 800GI, 150Mbps @ 400GI (Max.)</li><li>» 2Nss: 270Mbps @ 800GI, 300Mbps @ 400GI (Max.)</li></ul></li></ul></li></ul>



---

## Operating Channels

- » 802.11a/n
  - » USA/Canada: 23 non-overlapping channels
  - » Major Europe Countries: 19 non-overlapping channels
  - » Japan: 19 non-overlapping channels
  - » China: 5 non-overlapping channels
- » 802.11b/g/n
  - » USA/Canada: 11 (1~11)
  - » Major Europe Countries: 13 (1~13)
  - » France: 4 (10~13)
  - » Japan: 14 for 802.11b (1~13 or 14th), 13 for 802.11g (1~13)
  - » China: 13 (1~13)

---

## Output Power [ total 3 chains composite power level ]

- » 802.11a:
  - » +24.8dBm @ 6, 9, 12, 18, 24Mbps
  - » +23.8dBm @ 36Mbps
  - » +22.8dBm @ 48Mbps
  - » +22.8dBm @ 54Mbps
- » 802.11b:
  - » +27.8dBm
- » 802.11g:
  - » +27.8dBm @ 6, 9, 12, 18, 24Mbps
  - » +26.8dBm @ 36Mbps
  - » +25.8dBm @ 48Mbps
  - » +24.8dBm @ 54Mbps
- » 802.11n 2.4GHz/HT20:
  - » +27.8dBm @ MCS 0/8
  - » +27.8dBm @ MCS 1/9
  - » +27.8dBm @ MCS 2/10
  - » +27.8dBm @ MCS 3/11
  - » +26.8dBm @ MCS 4/12
  - » +25.8dBm @ MCS 5/13
  - » +24.8dBm @ MCS 6/14
  - » +24.8dBm @ MCS 7/15

- 
- » 802.11n 2.4GHz/HT40:
    - » +24.8dBm @ MCS 0/8
    - » +24.8dBm @ MCS 1/9
    - » +24.8dBm @ MCS 2/10
    - » +24.8dBm @ MCS 3/11
    - » +24.8dBm @ MCS 4/12
    - » +24.8dBm @ MCS 5/13
    - » +23.8dBm @ MCS 6/14
    - » +23.8dBm @ MCS 7/15
  - » 802.11n 5GHz/HT20:
    - » +25.8dBm @ MCS 0/8
    - » +25.8dBm @ MCS 1/9
    - » +24.8dBm @ MCS 2/10
    - » +23.8dBm @ MCS 3/11
    - » +22.8dBm @ MCS 4/12
    - » +21.8dBm @ MCS 5/13
    - » +20.8dBm @ MCS 6/14
    - » +19.8dBm @ MCS 7/15
  - » 802.11n 5GHz/HT40:
    - » +23.8dBm @ MCS 0/8
    - » +23.8dBm @ MCS 1/9
    - » +23.8dBm @ MCS 2/10
    - » +22.8dBm @ MCS 3/11
    - » +21.8dBm @ MCS 4/12
    - » +20.8dBm @ MCS 5/13
    - » +19.8dBm @ MCS 6/14
    - » +18.8dBm @ MCS 7/15
-

---

## Receiver Sensitivity

### » 802.11a:

Data Rate	IEEE Spec(1 Rx dBm)	Typical/Maximum( 3Rx dBm)
6M	-82	-93/-89
9M	-81	-93/-89
12M	-79	-93/-89
18M	-77	-92/-88
24M	-74	-89/-85
36M	-70	-86/-82
48M	-66	-82/-78
54M	-65	-80/-76

### » 802.11b:

Data Rate	IEEE Spec(1 Rx dBm)	Typical/Maximum( 3Rx dBm)
1M	-82	-96/-92
5.5M	-80	-93/-89
11M	-76	-90/-86

### » 802.11g:

Data Rate	IEEE Spec(1 Rx dBm)	Typical/Maximum( 3Rx dBm)
6M	-82	-95/-91
9M	-81	-95/-91
12M	-79	-95/-91
18M	-77	-94/-90
24M	-74	-91/-87
36M	-70	-88/-84
48M	-66	-84/-80
54M	-65	-82/-78

### » 802.11a/n, HT20:

Data Rate	IEEE Spec(1 Rx dBm)	Typical/Maximum( 3Rx dBm)
MCS0	-82	-93/-89
MCS1	-79	-92/-88
MCS2	-77	-90/-86
MCS3	-74	-86/-82
MCS4	-70	-83/-79
MCS5	-66	-79/-75
MCS6	-65	-80/-76
MCS7	-64	-76/-72

---

» 802.11a/n, HT40:

Data Rate	IEEE Spec(1 Rx dBm)	Typical/Maximum( 3Rx dBm)
MCS0	-79	-90/-87
MCS1	-76	-89/-85
MCS2	-74	-87/-83
MCS3	-71	-84/-80
MCS4	-67	-81/-77
MCS5	-63	-77/-73
MCS6	-62	-76/-72
MCS7	-61	-73/-69

» 802.11b/g/n, HT20:

Data Rate	IEEE Spec(1 Rx dBm)	Typical/Maximum( 3Rx dBm)
MCS0	-82	-95/-91
MCS1	-79	-94/-90
MCS2	-77	-92/-88
MCS3	-74	-86/-82
MCS4	-70	-82/-78
MCS5	-66	-81/-77
MCS6	-65	-80/-76
MCS7	-64	-77/-73

» 802.11b/g/n, HT40:

Data Rate	IEEE Spec(1 Rx dBm)	Typical/Maximum( 3Rx dBm)
MCS0	-79	-89/-85
MCS1	-76	-89/-85
MCS2	-74	-89/-85
MCS3	-71	-86/-82
MCS4	-67	-83/-79
MCS5	-63	-79/-75
MCS6	-62	-77/-73
MCS7	-61	-74/-70

---

---

Power Consumption [ 3T3R @ 25°C ]

	3.3V	5.0V	Standby
11a (Avg/Max) mA	927/1006	554/596	397/431
11b (Avg/Max) mA	340/388	977/1024	339/373
11g (Avg/Max) mA	365/400	981/1033	339/373
11n/2.4GHz (Avg/Max) mA	393/429	774/827	339/373
11n/5GHz (Avg/Max) mA	928/1011	459/518	397/431

---

Antenna

three DIP MMCX RF connector for robust antenna assembly

Remark: please make sure to install three antennas on these three antenna ports before power on. For less than three antennas application, a 50 ohm terminator (or Unex's ACMCX-2) on each opened antenna port is required before power on. This is a high-power module, PA will be damaged and cause DC-short if leave antenna port open during transmission.

---

MAC Protocol

CSMA/CA with ACK architecture 32-bit MAC

---

Security

- » 64-bit, 128-bit and 152-bit WEP encryption
  - » 802.1x authentication
  - » AES-CCM & TKIP encryption
- 

Operation Systems Supported

- » Linux
  - » Atheros Linux SDK for AP and client-mode sub-license available by project.
- 

Frequency Tolerance

transmitted center frequency tolerance  $\pm 20$ ppm max.

---

Dimension

65.8mm (L) x 59.6mm (W) x 1.0mm (T)

---

---

Operation  
Temperature  
Range

-40°C ~ +75°C

---

Storage  
Temperature  
Range

-40°C ~ +80°C

---

Operating  
Humidity

10% ~ 95%, non-condensing

---

Storage  
Humidity

max. 95%, non-condensing

---

Environment-  
Friendly  
Compliance

REACH and RoHS

## Ordering Information:

DNMA-H5	Industrial-grade, high-power 802.11n a/b/g wifi 3x3 mini-PCI module w/ESD and Surge Protection, AR9160-BC1B+AR9106
---------	--

---

ESD Cable	UL 1007 18AWG, length 19cm, for ground end to enclosure point tied to Earth Ground.
-----------	---

---

ACMCX-2	50 Ohm MMCX terminator
---------	------------------------

### Important Notices on Application:

1. Please make sure to install three antennas on these three antenna ports before power on. For less than three antennas application, a 50 ohm terminator (or Unex's ACMCX-2) on each opened antenna port is required before power on.
2. Please do not transmit power levels exceed max. target power in EEPROM's setting.
3. Please follow Unex's instruction document of single carrier test if test conducted.

**Wireless radio modules are ESD sensitive, especially the components such as RF switch and the power amplifier. To avoid damage by electrostatic discharge, the following installation procedure is recommended:**

- » Touch your hands and the bag or tray containing the radio module to a ground point on the host board (for example one of the mounting holes).
- » Install the radio module in the corresponding socket of host board.
- » Install the pigtail cable in the cutout of the enclosure. This will ground the pigtail to the enclosure.
- » Touch the I-PEX connector of the pigtail to the mounting hole (discharge), then plug onto the radio module.
- » Use external lightning protection for outdoor applications.
- » Make sure all antennas are being connected with the radio module (don't leave I-PEX connector open) before powering on the host device.