# Product Specification for model DHXA-222

802.11a/b/g/n WiFi and BT Comb PCIe Half Mini-card

**Version 1.1**

**2012/06/20**

**Networking Business Unit**
**Wistron Neweb® Corporation**

**CONFIDENTIAL**

## Revision History

| Version | Change history | Date |
|---|---|---|
| V1.0 | Initial version | 2012/04/11 |
| V1.1 | Add pin define | 2012/06/20 |
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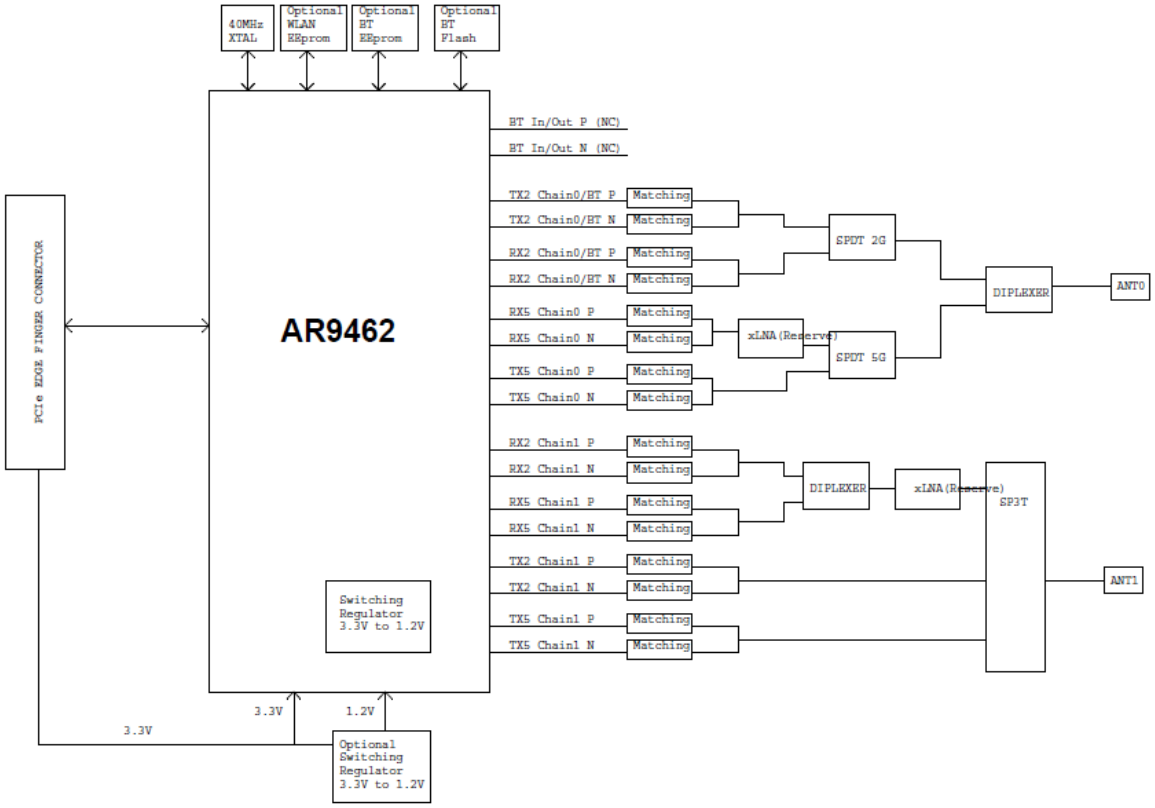
| | | |

## System Block Diagram



## DHXA-222, Product Specification, 802.11n b/g PCIe Half mini card

### 1. WiFi 11n portion

| Item | Key specifications |
|---|---|
| Main chipset | ➢ Atheros® AR9462 |
| TX/RX | ➢ 2T2R |
| Frequency range | ➢ USA: 2.400 ~ 2.483GHz 、5.15 ~ 5.35GHz 、5.47 ~ 5.725GHz、5.725 ~ 5.85GHz<br>➢ Europe: 2.400 ~ 2.483GHz、5.15 ~ 5.35GHz, 5.47 ~ 5.725GHz<br>➢ Japan: 2.400 ~ 2.497GHz、5.15 ~ 5.35GHz, 5.47 ~ 5.725GHz<br>➢ China: 2.400 ~ 2.483GHz、5.725 ~ 5.85GHz |
| Modulation technique | ➢ 802.11 Legacy b/g<br>DSSS (DBPSK, DQPSK, CCK)<br>OFDM (BPSK, QPSK, 16-QAM, 64-QAM)<br>DSSS (Direct Sequence Spread Spectrum) with<br>DBPSK (Differential Binary Phase Shift Keying 1Mbps),<br>DQPSK (Differential Quaternary Phase Shift Keying 2Mbps), and<br>CCK (Complementary Code Keying 5.5&11Mbps), and<br>OFDM (Orthogonal Frequency Division Multiplexing with BPSK for 6,9Mbps、<br>QPSK for 12,18Mbps、 16QAM for 24,36Mbps、 64QAM for 48,54Mbps)<br>➢ 802.11n<br>OFDM (BPSK, QPSK, 16-QAM, 64-QAM) |
| Host interface | ➢ PCI Express® Mini Card Electromechanical Specification Revision 1.2 |
| Channel spacing | ➢ 5MHz |
| Channels support | ➢ 802.11 b/g/n<br>US/Canada: 11 (1 ~ 11)<br>Major European country: 13 (1 ~ 13)<br>France: 4 (10 ~ 13)<br>Japan: 11b: 14 (1~13 or 14th), 11g: 13 (1 ~ 13)<br>China: 13 (1 ~ 13)<br>➢ 802.11 a/n<br>US/Canada: 12 non-overlapping channels (36,40,44,48,52,56,60,64; 100,104,108,112,116,120,124,128,132,136,140; 149,153,157,161,165)<br>Europe: 19 non-overlapping channel (36,40,44,48,52,56,60,64; 100,104,108,112,116,120,124,128,132,136,140)<br>Japan: 19 non-overlapping channels (36,40,44,48,52,56,60,64; 100,104,108,112,116,120,124,128,132,136,140)<br>China: 5 non-overlapping channels (149,153,157,161,165) |
| Operation voltage | ➢ 3.3V +/- 9% |
| Power consumption @25 °C | ➢ (mA) 802.11a Avg; 802.11b Avg; 802.11g Avg; 802.11n(2.4GHz) Avg; 802.11n(5GHz) Avg<br>Continue Tx: 550; 405; 436; 365; 445<br>***The maximum current consumption would be impacted by radiation environment and the driver mechanism. |

**Output power (for each chain; tolerance +2/2 dB)**

- **802.11a**

| Test Frequencies | 6-24_Target | 36_Target | 48_Target | 54_Target |
|---|---|---|---|---|
| 5180 | 15 | 14 | 13 | 11 |
| 5320 | 15 | 14 | 13 | 11 |
| 5825 | 15 | 14 | 13 | 11 |

- **802.11b**

| Test Frequencies | 1/2_Target | 5.5_Target | 11_Target |
|---|---|---|---|
| 2412 | 17 | 17 | 17 |
| 2472 | 17 | 17 | 17 |
| 2484 | 17 | 17 | 17 |

- **802.11g**

| Test Frequencies | 6-24_Target | 36_Target | 48_Target | 54_Target |
|---|---|---|---|---|
| 2412 | 17 | 17 | 16 | 15 |
| 2437 | 17 | 17 | 16 | 15 |
| 2472 | 17 | 17 | 16 | 15 |

- **802.11n**

**Freq. Range: HT20**

| Test Freq | MCS 0/8 | MCS 1/9 | MCS 2/10 | MCS 3/11 | MCS 4/12 | MCS 5/13 | MCS 6/14 | MCS 7/15 |
|---|---|---|---|---|---|---|---|---|
| 5180 | 14 | 14 | 14 | 14 | 13 | 12 | 11 | 9 |
| 5320 | 14 | 14 | 14 | 14 | 13 | 12 | 11 | 9 |
| 5825 | 14 | 14 | 14 | 14 | 13 | 12 | 11 | 9 |

**Freq. Range: HT40**

| Test Freq | MCS 0/8 | MCS 1/9 | MCS 2/10 | MCS 3/11 | MCS 4/12 | MCS 5/13 | MCS 6/14 | MCS 7/15 |
|---|---|---|---|---|---|---|---|---|
| 5180 | 14 | 14 | 14 | 14 | 13 | 12 | 11 | 9 |
| 5320 | 14 | 14 | 14 | 14 | 13 | 12 | 11 | 9 |
| 5825 | 14 | 14 | 14 | 14 | 13 | 12 | 11 | 9 |

**Freq. Range: HT20**

| Test Freq | MCS 0/8 | MCS 1/9 | MCS 2/10 | MCS 3/11 | MCS 4/12 | MCS 5/13 | MCS 6/14 | MCS 7/15 |
|---|---|---|---|---|---|---|---|---|
| 2412 | 17 | 17 | 17 | 17 | 17 | 16 | 15 | 14 |
| 2437 | 17 | 17 | 17 | 17 | 17 | 16 | 15 | 14 |
| 2472 | 17 | 17 | 17 | 17 | 17 | 16 | 15 | 14 |

**Freq. Range: HT40**

| Test Freq | MCS 0/8 | MCS 1/9 | MCS 2/10 | MCS 3/11 | MCS 4/12 | MCS 5/13 | MCS 6/14 | MCS 7/15 |
|---|---|---|---|---|---|---|---|---|
| 2412 | 16 | 16 | 16 | 16 | 16 | 16 | 15 | 14 |
| 2437 | 16 | 16 | 16 | 16 | 16 | 16 | 15 | 14 |
| 2472 | 16 | 16 | 16 | 16 | 16 | 16 | 15 | 14 |

**EVM**

**The transmit modulation accuracy is measured using error vector magnitude (EVM). EVM is the magnitude of the phase difference as a function of time between an ideal reference signal and the measured transmitted signal.**

- **802.11b**

| Modulation | Code Rate | Relative constellation error (dB) IEEE Spec | Relative constellation error (dB) Typical/ Maximum |
|---|---|---|---|
| DBPSK | | -10 | -16/ -14 |
| DQPSK | | -10 | -16/ -14 |
| CCK | | -10 | -16/ -14 |

- **802.11g**

| Modulation | Code Rate | Relative constellation error (dB) IEEE Spec | Relative constellation error (dB) Typical/ Maximum |
|---|---|---|---|
| BPSK | 1/2 | -5 | -30/ -26 |
| BPSK | 3/4 | -8 | -30/ -26 |

| | | | | |
|---|---|---|---|---|
| | QPSK | 1/2 | -10 | -30/ -26 |
| | QPSK | 3/4 | -13 | -30/ -26 |
| | 16-QAM | 1/2 | -16 | -30/ -26 |
| | 16-QAM | 3/4 | -19 | -30/ -26 |
| | 64-QAM | 2/3 | -22 | -30/ -26 |
| | 64-QAM | 3/4 | -25 | -30/ -26 |
| | ➢ 802.11ng | | | |
| | Modulation | Code Rate | Relative constellation error (dB) IEEE Spec | Relative constellation error (dB) Typical/ Maximum |
| | ✧ HT20 | | | |
| | (MCS0) BPSK | 1/2 | -5 | -29/ -26 |
| | (MCS1) QPSK | 1/2 | -10 | -29/ -26 |
| | (MCS2) QPSK | 3/4 | -13 | -29/ -26 |
| | (MCS3) 16-QAM | 1/2 | -16 | -29/ -26 |
| | (MCS4) 16-QAM | 3/4 | -19 | -29/ -26 |
| | (MCS5) 64-QAM | 2/3 | -22 | -29/ -26 |
| | (MCS6) 64-QAM | 3/4 | -25 | -29/ -26 |
| | (MCS7) 64-QAM | 5/6 | -28 | -29/ -28 |
| | ✧ HT40 | | | |
| | (MCS0) BPSK | 1/2 | -5 | -29/ -26 |
| | (MCS1) QPSK | 1/2 | -10 | -29/ -26 |
| | (MCS2) QPSK | 3/4 | -13 | -29/ -26 |
| | (MCS3) 16-QAM | 1/2 | -16 | -29/ -26 |
| | (MCS4) 16-QAM | 3/4 | -19 | -29/ -26 |
| | (MCS5) 64-QAM | 2/3 | -22 | -29/ -26 |
| | (MCS6) 64-QAM | 3/4 | -25 | -29/ -26 |
| | (MCS7) 64-QAM | 5/6 | -28 | -29/ -28 |
| Sensitivity | ➢ 802.11b | | | |
| | Modulation | | IEEE Spec (dBm) | Typical/ Maximum (dBm) |
| | DBPSK | | not specified | -93/ -90 |
| | DQPSK | | not specified | -90/ -88 |
| | CCK | | not specified | -87/ -85 |
| | ➢ 802.11g | | | |
| | Modulation | Code Rate | IEEE Spec (1Rx dBm) | Typical/Maximum (2Rx dBm) |
| | BPSK | 1/2 | -82 | -90/ -88 |
| | BPSK | 3/4 | -81 | -92/ -87 |
| | QPSK | 1/2 | -79 | -91/ -86 |
| | QPSK | 3/4 | -77 | -88/ -84 |
| | 16-QAM | 1/2 | -74 | -85/ -81 |
| | 16-QAM | 3/4 | -70 | -81/ -77 |
| | 64-QAM | 2/3 | -66 | -78/ -73 |
| | 64-QAM | 3/4 | -65 | -77/ -72 |
| | ➢ 802.11ng | | | |
| | Modulation | Code Rate | IEEE Spec (1Rx dBm) | Typical/Maximum (2Rx dBm) |
| | ✧ HT20 | | | |
| | (MCS0) BPSK | 1/2 | -82 | -90/ -87 |
| | (MCS1) QPSK | 1/2 | -79 | -89/ -84 |
| | (MCS2) QPSK | 3/4 | -77 | -87/ -82 |
| | (MCS3) 16-QAM | 1/2 | -74 | -84/ -79 |
| | (MCS4) 16-QAM | 3/4 | -70 | -80/ -75 |
| | (MCS5) 64-QAM | 2/3 | -66 | -76/ -71 |
| | (MCS6) 64-QAM | 3/4 | -65 | -75/ -70 |
| | (MCS7) 64-QAM | 5/6 | -64 | -74/ -69 |

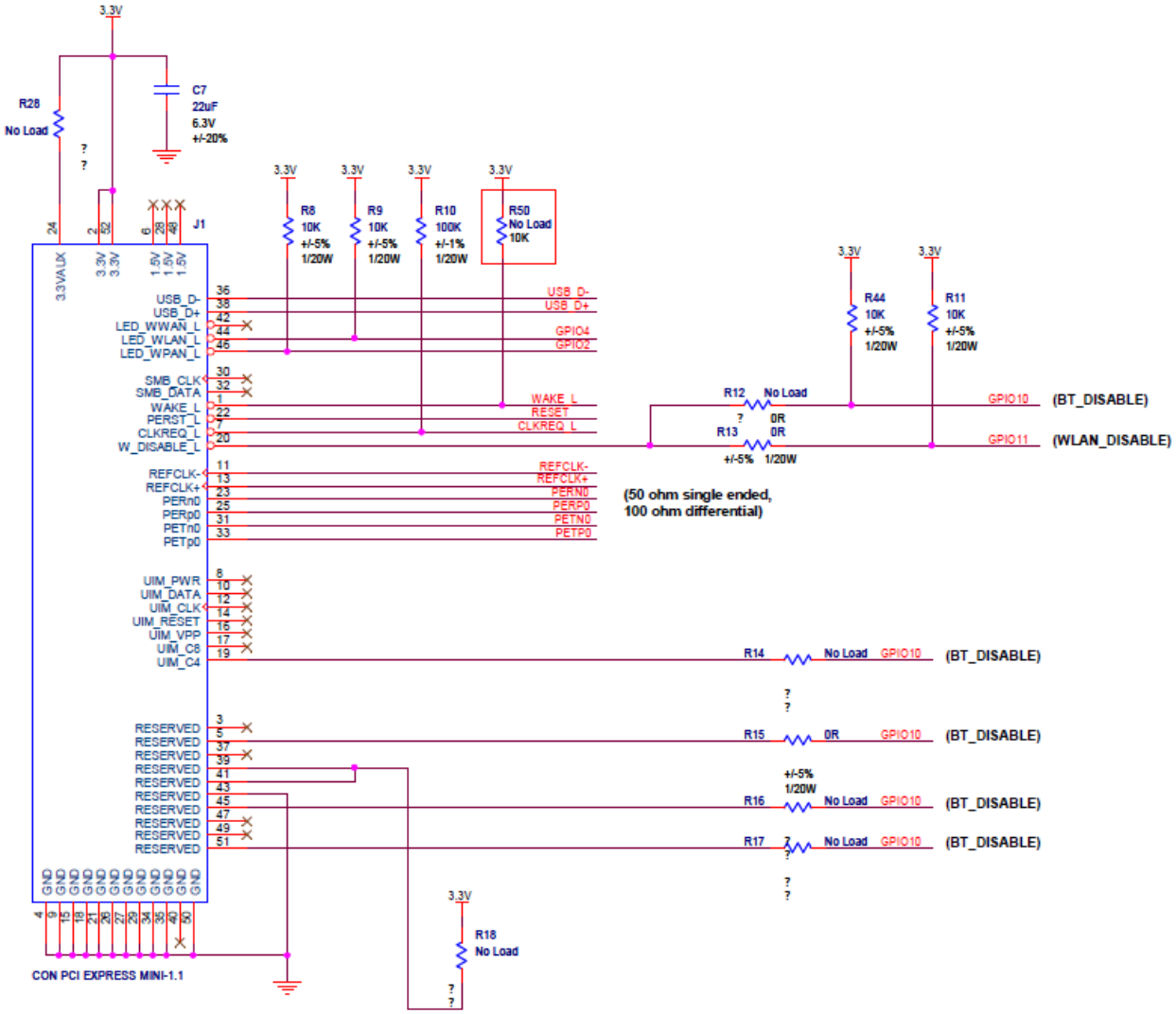
| | |
|---|---|
| | ✧ **HT40**<br>**(MCS0) BPSK 1/2 -79 -89/ -84**<br>**(MCS1) QPSK 1/2 -76 -86/ -81**<br>**(MCS2) QPSK 3/4 -74 -84/ -79**<br>**(MCS3) 16-QAM 1/2 -71 -81/ -76**<br>**(MCS4) 16-QAM 3/4 -67 -77/ -72**<br>**(MCS6) 64-QAM 3/4 -62 -72/ -67**<br>**(MCS7) 64-QAM 5/6 -61 -71/ -66** |
| **Operation distance** | ➢ **802.11a**<br>**Outdoor: 50 m @54Mbps, 300 m @6Mbps**<br>**Indoor: 30 m @54Mbps, 100 m @6Mbps**<br>➢<br>➢ **802.11b**<br>**Outdoor: 100 m @11Mbps, 200 m @1Mbps**<br>**Indoor: 50 m @11Mbps, 100 m @1Mbps**<br>➢ **802.11g**<br>**Outdoor: 100 m @54Mbps, 200 m @6Mbps**<br>**Indoor: 50 m @54Mbps, 100 m @6Mbps**<br>➢ **802.11n**<br>**Outdoor：250 m @6.5Mbps (MCS0: 1 Nss/20MHz BW)**<br>**30 m @130Mbps (MCS15: 2 Nss/20MHz BW)**<br>**30 m @300Mbps (MCS15: 2 Nss/40MHz BW)**<br>**Indoor： 100 m @6.5Mbps (MCS0: 1 Nss/20MHz BW)**<br>**20 m @130Mbps (MCS15: 2 Nss/20MHz BW)**<br>**20 m @300Mbps (MCS15: 2 Nss/40MHz BW)** |
| **Transmit spectrum mask** | ➢ **For transmitted spectral mask for 11b shall be less than –50dBr for 22MHz<f<fc+22MHz.**<br>**For transmitted spectral mask for 11g shall be less than –40dBr for fc–30MHz<f<fc+30MHz.**<br>➢ **For transmitted spectral mask for 11n 20MHz shall be less than –45dBr for fc–30MHz<f<fc+30MHz.**<br>➢ **For transmitted spectral mask for 11n 40MHz shall be less than –45dBr for fc–60MHz<f<fc+60MHz.** |
| **Transmit spectrum flatness** | ➢ **For 802.11g the average energy of the constellations in each of spectral lines –16..-1 and +1..+16 will deviate no more than +/- 2dB from their average energy.**<br>➢ **For 802.11n 40MHz mode, the average energy of the constellations in each of spectral lines –42..-2 and +2..+42 will deviate no more than +/- 2dB from their average energy.**<br>➢ **The transmitted spectral flatness should be with in +2/- 4dB.** |
| **Transmit center frequency tolerance** | ➢ **The transmitted center frequency tolerance shall be ±20 ppm maximum.** |
| **Carrier suppression** | **802.11a:**<br>**The leakage of the center frequency component shall not exceed -15 dB relative to overall transmitted power or, equivalently, +2 dB relative to the average energy of the rest of the sub-carriers.**<br>**802.11b:**<br>**The RF carrier suppression, measured at the channel center frequency, shall be at least 15 dB below the peak SIN(x)/x power spectrum.**<br>**802.11g:**<br>**The leakage of the center frequency component shall not exceed -15 dB relative to overall transmitted power or, equivalently, +2 dB relative to the average energy of the rest of the sub-carriers.**<br>**802.11n:**<br>**For all 20 MHz modes of transmission**<br>**The leakage of the center frequency component shall not exceed -15 dB relative to overall transmitted power or, equivalently, +2 dB relative to the average energy of the rest of the sub-carriers.** |

| | |
|---|---|
| | **For all 40 MHz modes of transmission**<br>**The center frequency leakage shall not exceed -18 dB relative to overall transmitted power, or, equivalently, +2 dB relative to the average energy of the rest of the sub-carriers.**<br>➢ **Delta > 15dB for b, g & 11n 20MHz**<br>➢ **Delta > 18dB for 11n 40MHz** |
| **Transmit power on ramp and power down ramp time** | ➢ **The transmitting power-on ramp for 10% to 90% of maximum power m shall be no greater than 2 µs.**<br>➢ **The transmitting power-down ramp for 90% to 10% of maximum power shall be no greater than 2 µs.** |
| **Receiver maximum input level** | ➢ **802.11b**<br>**Modulation — IEEE Spec (dBm)**<br>**DBPSK — >-10**<br>**DQPSK — >-10**<br>**CCK — >-10**<br>➢ **802.11g**<br>**Modulation — Code Rate — IEEE Spec (dBm)**<br>**>-20**<br>➢ **802.11ng**<br>**Modulation — Code Rate — IEEE Spec (dBm)**<br>**>-20** |
| **Operation system supported** | ➢ **Windows® XP、Vista、Win 7** |
| **PCB dimension** | ➢ **26.65+/-0.15mm x 29.85+/-0.15mm x 1.0+/-0.1mm 4L FR4** |
| **Security** | ➢ **64-bit, 128-bit, 152-bit WEP Encryption**<br>➢ **802.1x Authentication**<br>➢ **AES-CCM & TKIP Encryption** |
| **Operation mode** | ➢ **Infrastructure & Ad-hoc mode (TBD)** |
| **Transfer data rate** | ➢ **802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps**<br>➢ **802.11b: 1, 2, 5.5, 11Mbps**<br>➢ **802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps**<br>➢ **802.11n: @800GI(400GI)**<br>● **20MHz BW**<br>▪ **65(72.2) Mbps maximal**<br>▪ **130(130) Mbps maximal**<br>● **40MHz BW**<br>▪ **135(150) Mbps maxima**<br>▪ **270(300) Mbps maxima** |
| **Operation temperature** | ➢ **0° ~ 60° C** |
| **Storage temperature** | ➢ **-20° ~ 80° C** |
| **Wi-Fi® alliance®** | ➢ **WECA Compliant** |
| **EMC certificate** | ➢ **FCC part 15 (USA)**<br>➢ **IC RSS210 (Canada)**<br>➢ **TELEC (Japan)**<br>➢ **ETSI, EN301893, EN60950 (Europe)**<br>➢ **VCCI CLASS B** |
| **Media access protocol** | ➢ **CSMA/CA with ACK architecture 32-bit MAC** |
| **Antenna** | ➢ **2 x SMT Ultra-miniature coaxial connectors (U.FL-R-SMT)** |

## 2. BT portion

| Item | Key specifications |
|---|---|
| Main chipset | ➢ Atheros® AR9462 |
| Compliance | ➢ Bluetooth v4.0 |
| Frequency range | ➢ 2400 ~ 2483.5MHz |
| Initial carrier frequency tolerance | ➢ +/- 40kHz (typical) |
| Modulation technique | ➢ Frequency hopping, 1600 hops/sec |
| Channel spacing | ➢ 1MHz |
| Channels support | ➢ 79 channels |
| Operation voltage | ➢ 3.3V +/- 9% |
| Power consumption @25 $^{o}$ C | Avg (mA)<br>➢ Idle mode 15.1<br>➢ Continuous DH5 TX 68.8<br>***The maximum current consumption would be impacted by radiation environment and the driver mechanism. |
| Output power (dBm) | ➢ 2dBm typical, class 2 device (-6dBm < output power <4dBm). |
| Sensitivity | ➢ -85 dBm (typ.) for pi/4-DQPSK, 0.1%BER |
| Operation temperature | ➢ 0$^{o}$ ~ 60$^{o}$ C |
| Storage temperature | ➢ -20$^{o}$ ~ 80$^{o}$ C |
| Antenna | ➢ 1 x SMT Ultra-miniature coaxial connectors (U.FL-R-SMT) |

- **Connector PCIe Mini-1.1 pin define**



**1. The pin definitions follow the minicard standard.**
**2. The pin 5 is defined as a BT disable control pin.**
**3. We reserved the pin 46 for BT LED.**
**Please advise your BT LED behavior if you need BT LED function.**
**Atheros will release a specific driver for your BT LED behavior.**

| Pin No. | Name | Direction | Description |
|---|---|---|---|
| 4,9,15,18,21,26,27,29,34, 35,37,43,50 | **GND** | --- | Ground. |
| 40 | **GND** | --- | No connection. |
| R24 | **RESERVED** | --- | Tied to ground. |
| 47,49 | **RESERVED** | --- | No connection. |
| 39,41, | **RESERVED** | --- | Reserved for 3.3V |
| 51 | **RESERVED** | --- | Reserved for BT_DISABLE |
| 45 | **RESERVED** | --- | Reserved for BT_DISABLE |
| 5 | **RESERVED** | --- | Reserved for BT_DISABLE |
| 3 | **RESERVED** | --- | No connection. |
| 19 | **RESERVED** | --- | Reserved for BT_DISABLE |
| 8,10,12,14,16,17, | **NC** | --- | No connection. |
| 33 | **PETp0** | Analog input signal | Differential receive |
| 31 | **PETn0** | Analog input signal | Differential receive |
| 25 | **PERP0** | Analog output signal | Differential trnasmit |
| 23 | **PERN0** | Analog output signal | Differential trnasmit |
| 13 | **REFCLK+** | Analog input signal | Differential reference clock (100MHz). |
| 11 | **REFCLK-** | Analog input signal | Differential reference clock (100MHz). |
| 20 | **WLAN_DISABLE_L** | I/O | WLAN DISABLE |
| 7 | **CLKREQ_L** | A digital output signal with open drain | Reference clock request, open drain |
| 22 | **PERST_L** | Input siganls with weak internal pull-down, to prevent siganls from floating when left open | PCI Express reset with weak pull down |
| 1 | **WAKE_L** | A digital output signal with open drain | Reserved for 3.3V or WAKE2_L (Request to service a fuction-initiated wake event, open drain). |
| 32 | **SMB_DATA** | --- | No connection. |
| 30 | **SMB_CLK** | --- | No connection. |
| 46 | **LED_WPAN_L** | O | GPIO2 |
| 44 | **LED_WLAN_L** | O | GPIO4 |
| 42 | **LED_WWAN_L** | --- | No connection. |
| 38 | **USB_D+** | I/O | USB_P |
| 36 | **USB_D-** | I/O | USB_N |
| 6,28,48 | **1.5V** | --- | No connection. |
| 2,52 | **3.3V** | --- | 3.3V |
| 24 | **3.3V** | --- | 3.3V |