

# AEX-AR95 Series

**Product: mPCIe 802.11a/b/g/n 2.4GHz/5GHz**

**AIRETOS E95 Series based on QCA XB116**

OPERATION MANUAL



## NOTICE

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# Revision History

## Revision Description of Changes

Releases	Date	Notes
Version 1.0	Aug. 2016	Initial Release
Version 1.1	June 2017	Updated version



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# 1. Document Conventions

TEXT CONVENTIONS	<b>bold</b>	Bold type within paragraph text indicates commands, file names, directory names, paths, output, or returned values.  Example: The DK_Client package will not function unless you use the wdreg_install batch file.
	<i>italic</i>	Within commands, italics indicate a variable that the user must specify.  Example: mem_alloc <i>size_in_bytes</i>  Titles of manuals or other published documents are also set in italics.
	Courier	The Courier font indicates output or display.  Example:  Error: Unable to allocate memory for transfer!
	Menu	The Menu character tag is used for menu items.  Example: Choose Edit > Copy.
	[ ]	Within commands, items enclosed in square brackets are optional parameters or values that the user can choose to specify or omit.
	{ }	Within commands, items enclosed in braces are options from which the user must choose.
		Within commands, the vertical bar separates options.
	...	An ellipsis indicates a repetition of the preceding parameter.
	>	The right angle bracket separates successive menu selections. Example: Start > Programs > DK > wdreg_install.
	“ ”	Within command, items are in window menu selection.
NOTICES		<b>NOTE:</b> This message denotes neutral or positive information that calls out important points to the text. A note provides information that may apply only in special cases.



## 2. Introduction

Thank you for using this high-speed AEX-AR95 SERIES 802.11a/b/g/n wireless network card. This wireless network adapter has the theoretical maximum data transfer rate at 450 Mbps, it also provides wide wireless coverage. This wireless network card supports MIMO (Multi-In, Multi-Out) technology, which uses two or three different radio channels to enhance data transfer rate and wireless coverage.

### 2-1. Production Description

- Dual Band 3x3

True Industrial Grade: The AEX-AR95 SERIES IEEE 802.11 a/b/g/n PCI-E WLAN is a highly integrated wireless, true full industrial grade module (series) for outdoor, enterprise and industrial level applications. Advance firmware features in the AEX-AR95 SERIES allow for 5/10/20/40MHz channel bandwidth, Enhanced Transmission Power Accuracy, High-resolution Spectral Analysis and so make this device the one of choice for modern industrial designs. Connect one, two or three antennas, as per your design specifications.

- Enterprise Features:

4.9GHz frequency band support / narrow 5/10MHz channelization, Dynamic Frequency Selection (DFS), QFN support, enhanced small packet performance, Multi-Country Roaming support (IEEE 802.11d, 802.11h Global Harmonization), Spatial Multiplexing, cyclic delay diversity (CDD), low-density parity check (LDPC), maximum ratio combining (MRC), space time block code (STBC)

- Enhancements over AR93xx: Video QoS (VQos), Dynamic Frequency Selection (DFS), Spectral Analysis, Support for loopback mode for FIPS security certification.



- Higher Output – Better Links:

The device adopts XSPAN with SST3 and Multiple In, Multiple Out (MIMO) technology with enhanced output aggregate power at 24dBm. Thus, it provides larger coverage and increased specific link throughput.

## 2-2. Top Features

- True Industrial Grade, for high humidity and under severe weather operation (-40° ~ +85°C)
- Dual Band (DB), 2.4Ghz + 5 Ghz wireless connection up to 450Mbps
- Three antenna connectors, for MIMO 3Tx3R (3 Transmit & 3 Receive) technology
- Enhanced Tx Power Accuracy with up to 24dBm aggregate output

## 3. System Requirements

Laptop/ PC with minima requirement:

- 32-bit PCI Express Bus
- 32 MB memory or greater
- 300 MHz processor or higher
- Windows XP/vista/7/8/10, Linux, OSX, Chrome OS

## 4. Preparation



This manual is giving instructions on how to install the driver into a Windows system. In this document, we will be using Windows 7 64bit version to demonstrate how to properly install the driver for AEX-AR95 SERIES series.

#### 4-1. Software

Make sure the driver package is fully downloaded and saved in to a dedicated location (ex. C:\).

The package of this driver should have below files:

- athr.sys
- athrext.cat
- athrextx.cat
- athrx.sys

#### 4-2. Hardware

Have the correct VoxMicro AEX-AR95 SERIES mPCIe adaptor and ensure there is no damage on the adaptor. Properly install the adaptor at the mPCIe slot and have the card securely seated. Please be noticed that you shall turn off the computer before the hardware installation. Once you have the hardware installed, you can start the driver installation process.



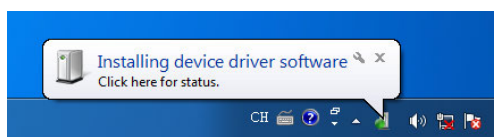


## 5. Window Driver Installation/Un-installation

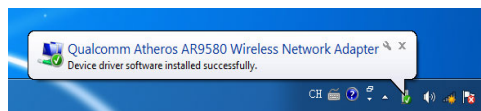
### 5-1. Auto installation

#### Auto Scanning

- Windows shall detect the change of hardware automatically and install the driver automatically. Please wait for few minutes for Windows to scan the hardware and finish the driver installation.
- Windows is installing the device



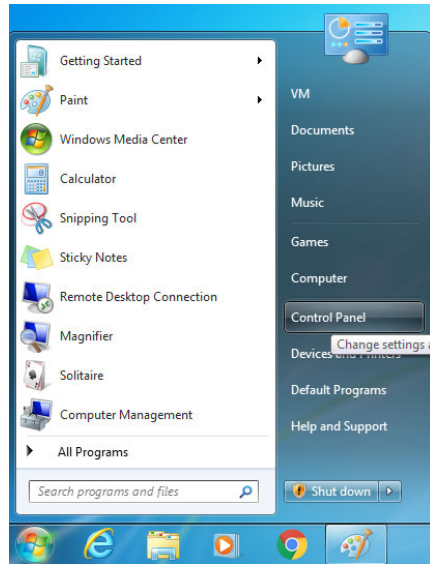
- Driver has successfully installed for AEX-AR95 SERIES



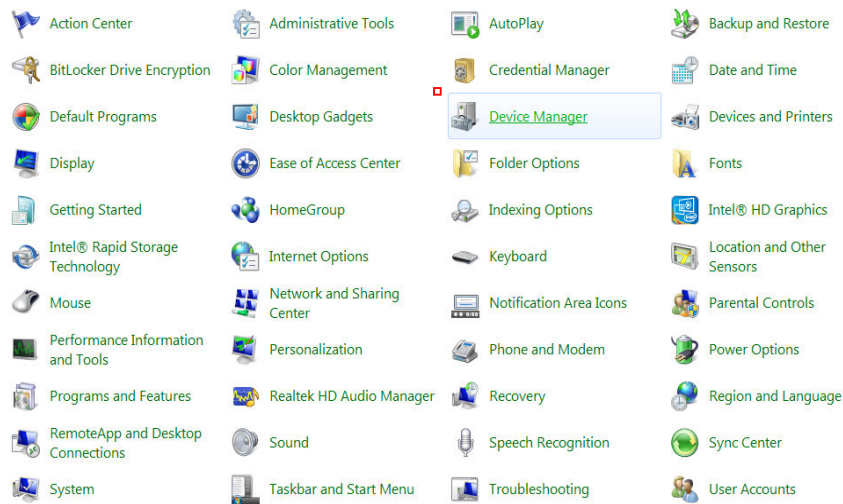
#### Manual triggered scanning

- If Windows didn't find the hardware, you can perform a manual triggered hardware scan by going to "Start" and select "Control Panel"



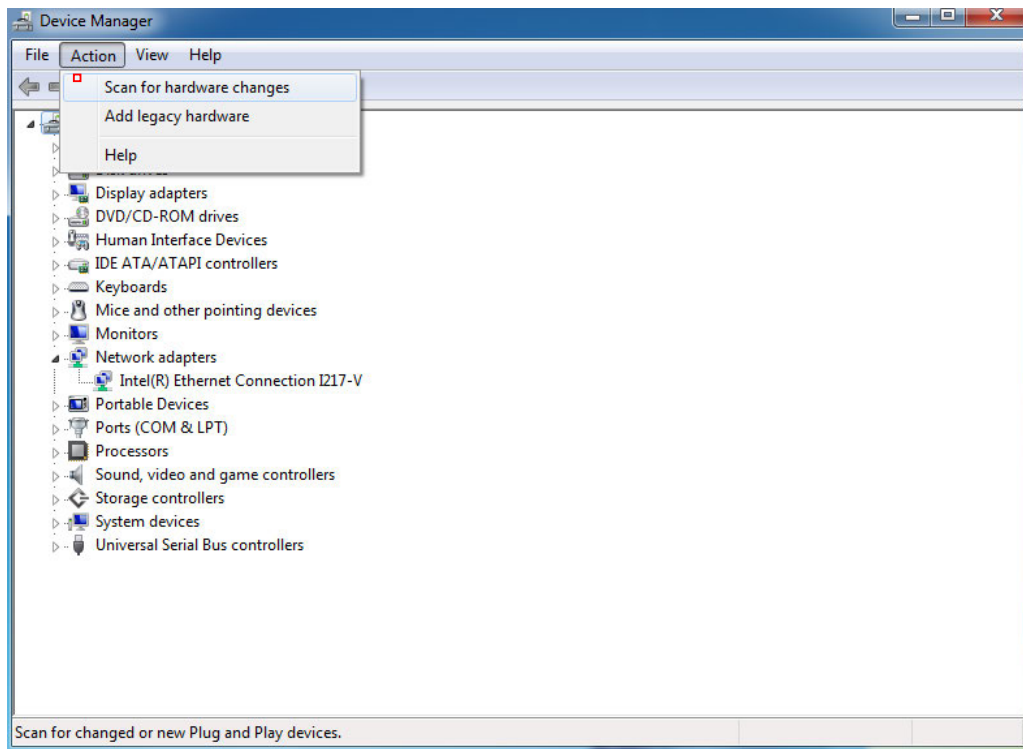


■ Select “Device Manager”

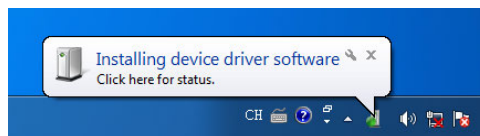


■ Go to “Action” and select “Scan for hardware changes”.

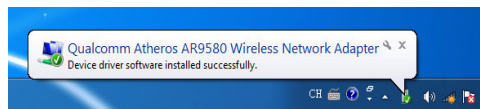




- Once Windows find the hardware, it will install the driver as earlier indicated.
- Windows is installing the device



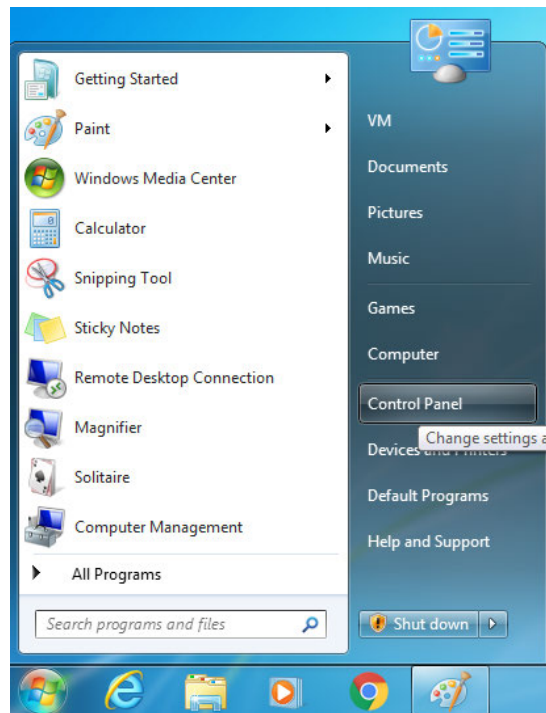
- Driver has been successfully installed for AEX-AR95 SERIES



## 6. Manual installation

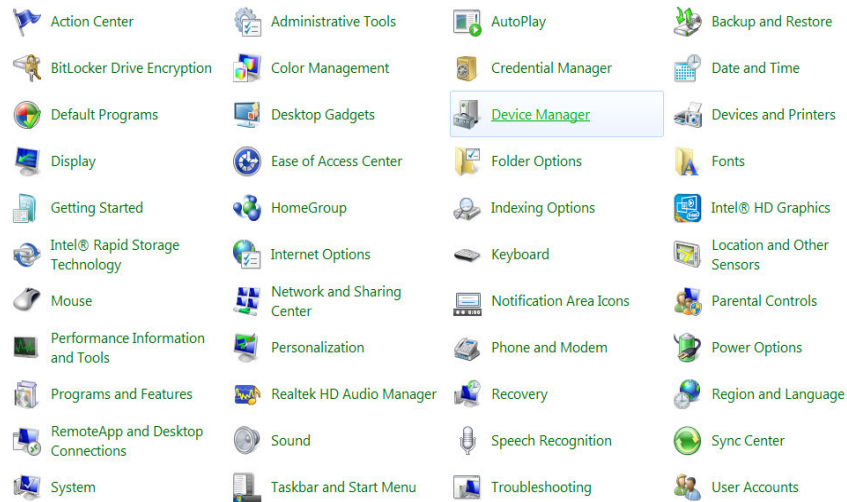
You can also install the driver manually if you wish to or if the driver wasn't installed automatically, follow the bellow steps to install driver manually.

- Make sure the driver packages are placed at a dedicated location.
- Go to start and select "**Control Panel**".

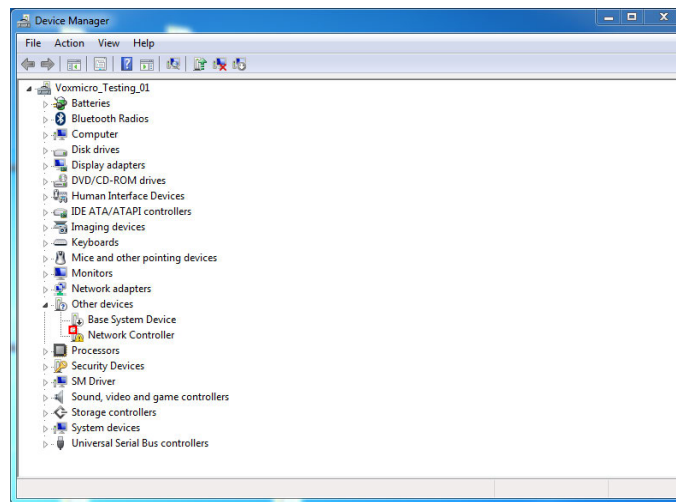


- Select "Device Manager".



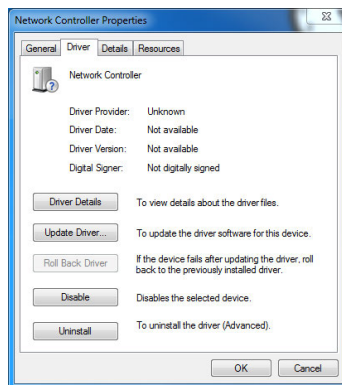


- Double click or Right click on the “**Network Controller**” and select “**Properties**”.



- Select the “**Driver**” tab on top of the pop up window and select the “**Update Driver**” button.

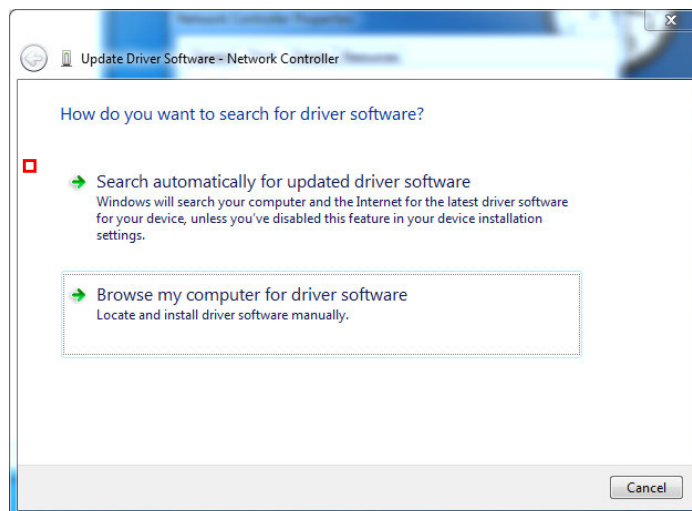




- There are 2 ways to update the driver. You can choose **“Search automatically”** or **“Browse my computer for driver software”**.

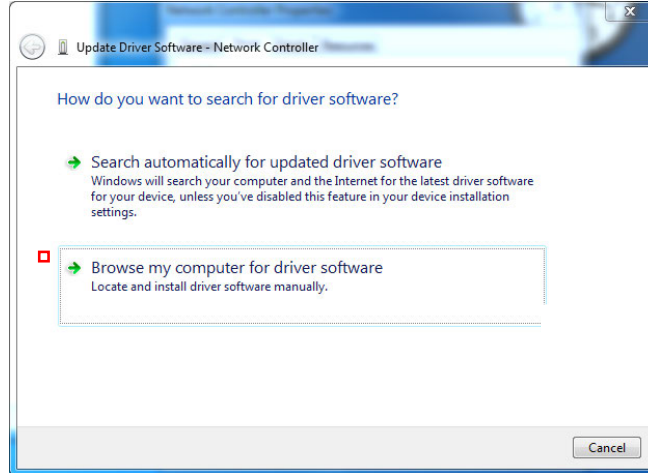
1. Search automatically.

Select below option, Windows will search your computer and the internet for the latest driver software for your device, unless you have disabled this feature in your device installation settings. Windows will install the driver once it is found.

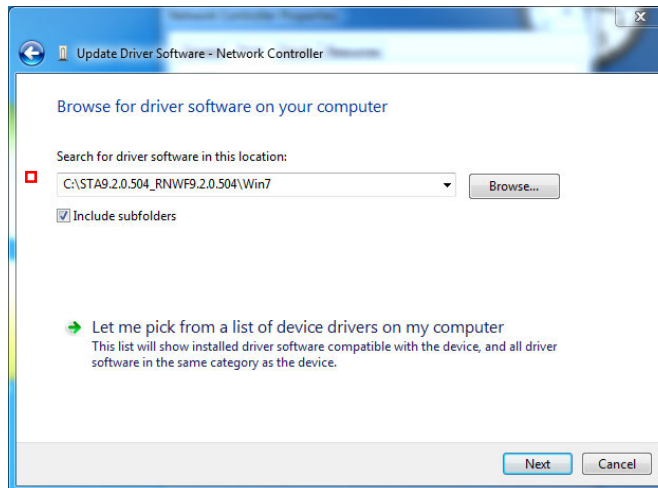


2. Browse my computer.

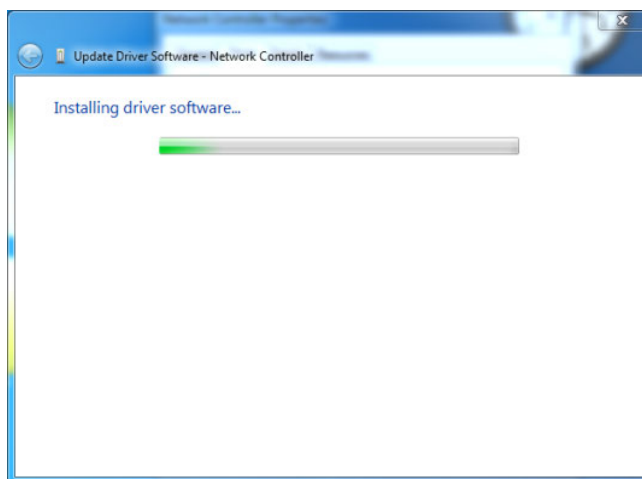
Select below option and browse the computer for driver software.



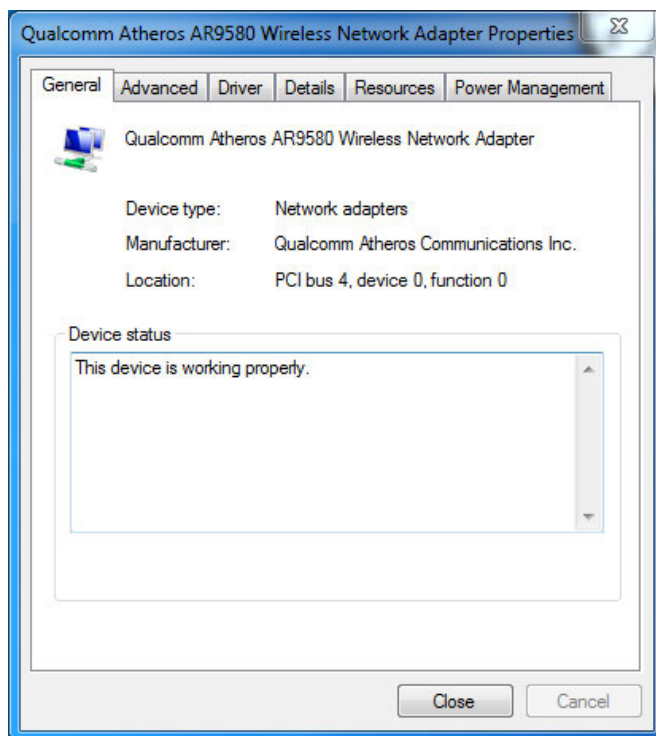
3. Press "Browse" to find the driver location than press "OK".



- Press “**Next**” and start the installation.



- When the installation is completed, you can go back to the device and check this status of the device. It will be indicating “**This device is working properly**” as below picture is showing.

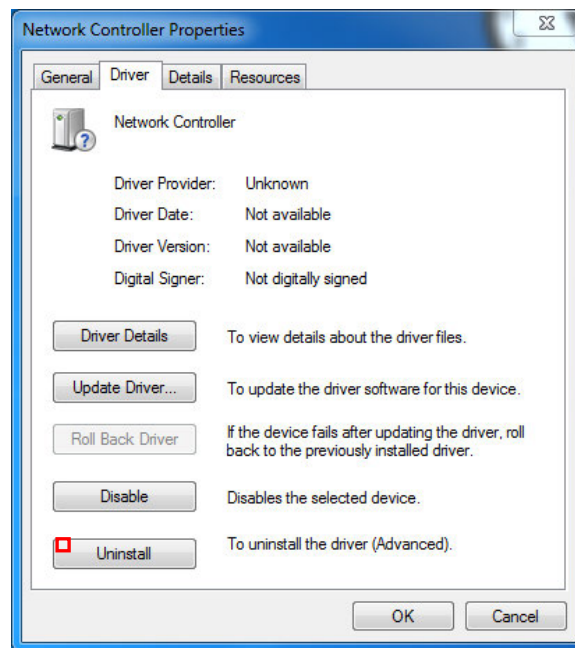




## 7. Un-installation

To remove the newly installed driver from the system if the system does not have previously installed versions of the NDIS driver, proceed to Step 4.

1. To remove the NDIS driver from the OS, go to Device Manager, right-click Atheros AR95 SERIES Wireless Network Adapter, and choose Uninstall.



2. Click OK to uninstall the device.
3. When the device is uninstalled from Device Manager, search for and delete the driver files that reside in the system.
  - Go to the Start menu and choose Search > For Files or Folders.
  - Enter oem\*.inf in the Search for files or folders named: field, and enter Atheros in the Containing text: field.
  - Click Search Now. A few files matching these criteria are possible, if previous drivers have not been removed properly.
  - Choose the files that have been found and delete them from the system.

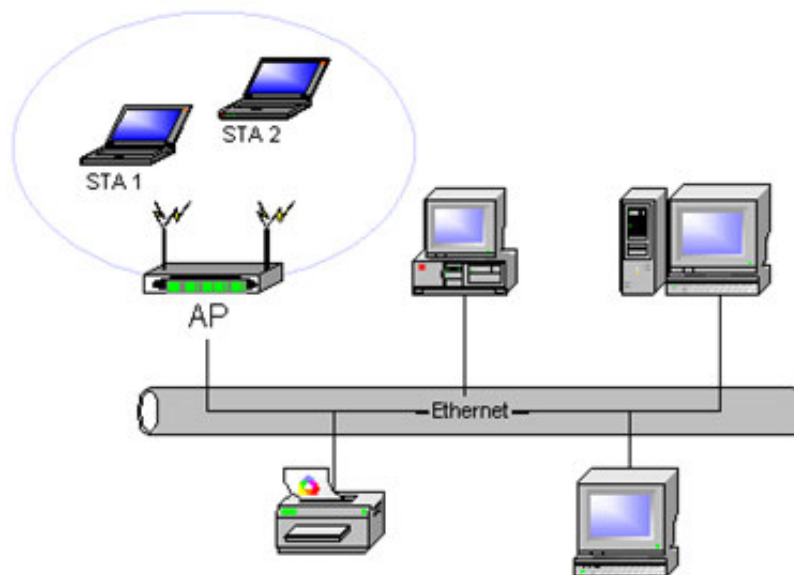


4. To complete the un-installation, remove the file **athrx.sys** from the folder **\windows\system32\drivers**.

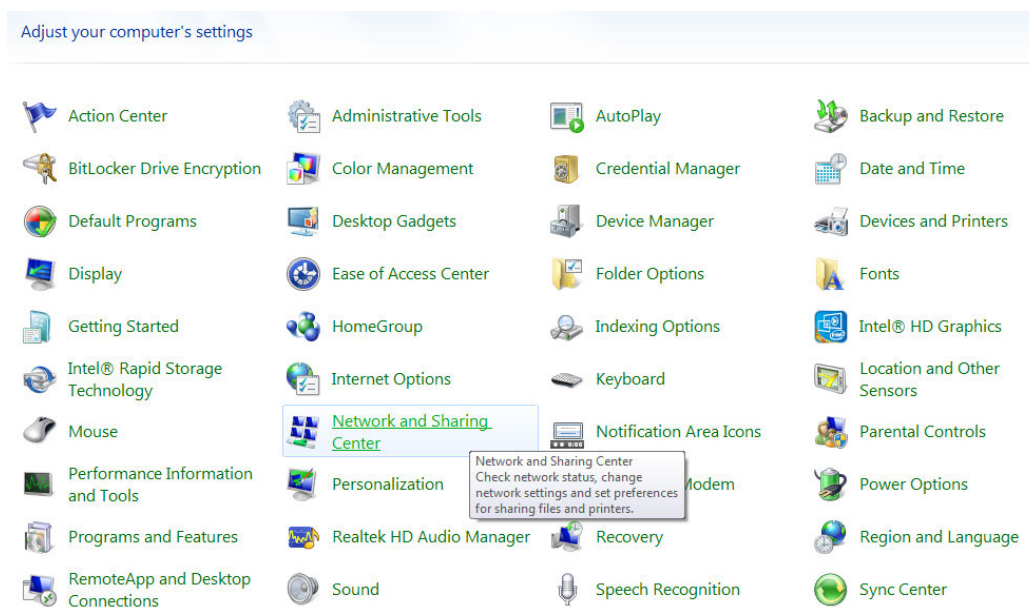
## 8. Connect to the internet

The device is now ready to set up a connection. In infrastructure (access point (AP)) mode, the wireless network adapter participates in a basic service set (BSS) as a station, and communicates with the other stations through an AP, as illustrated here.

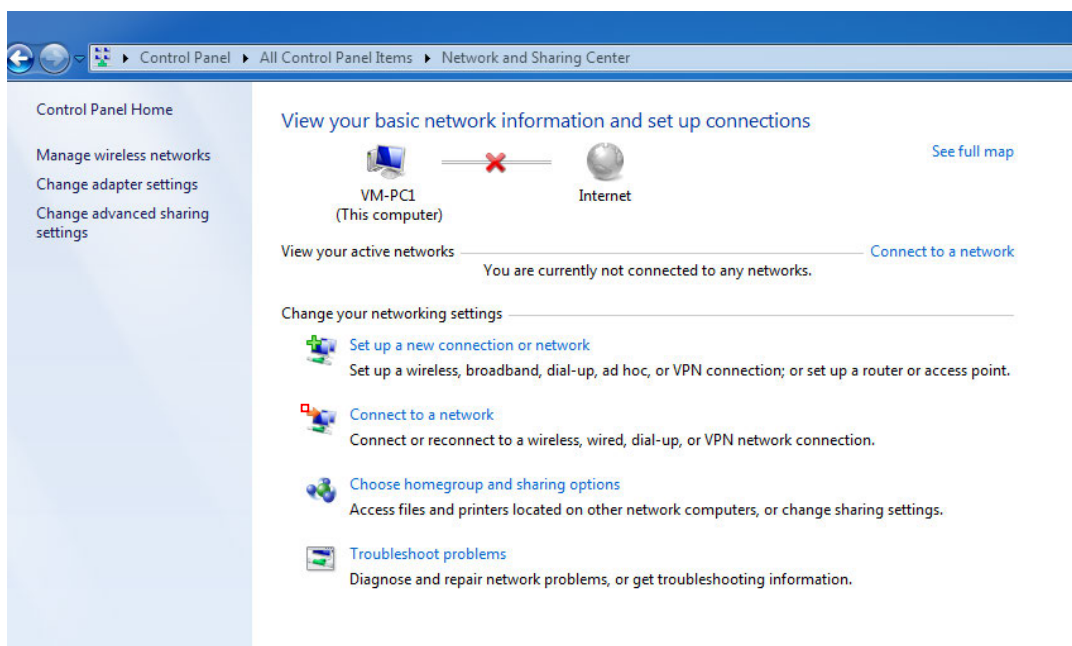
When the installation of the device is completed, the wireless network adaptor will appear, go to below location.



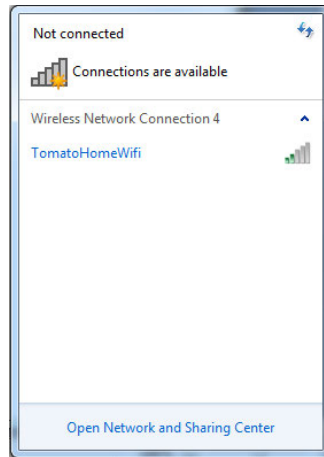
(i) Star > Control Panel > Network and Sharing Center.



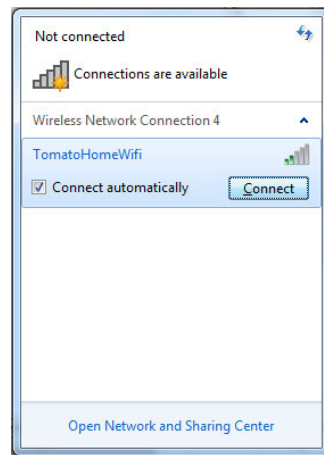
(ii) Select "Connect to a network ", a window will pop up with existing access points information.



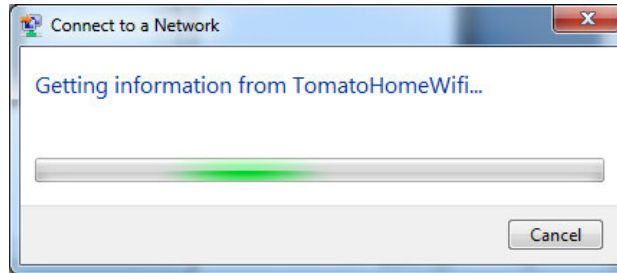
(iii) Select the access point that you like to connect to.



(iv) Select **"connect"**, it will try to connect to the access point that has been selected previously.



- (v) A hand shake process will be taken place between the wireless adaptor and the access point.

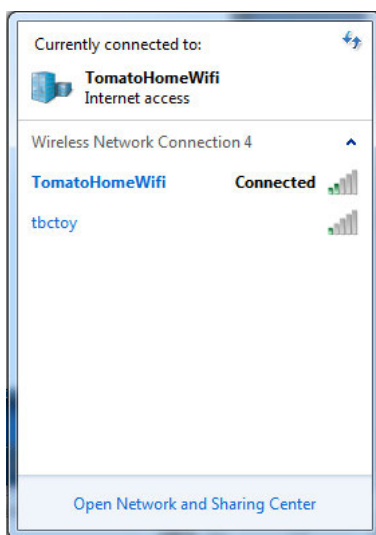


- (vi) Proper password will be needed for various security set up.



- (vii) The connection between the computer and the access point will be established once the authentication and authorization have been confirmed.

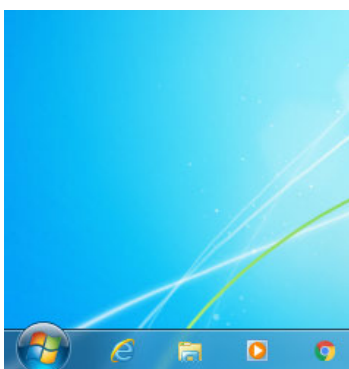




## 9. Connection verification

The device should have a connection with the access point. You can now connect to the internet cloud. Ping can be used for testing the physical link. For example, you can ping google IP using commend mode.

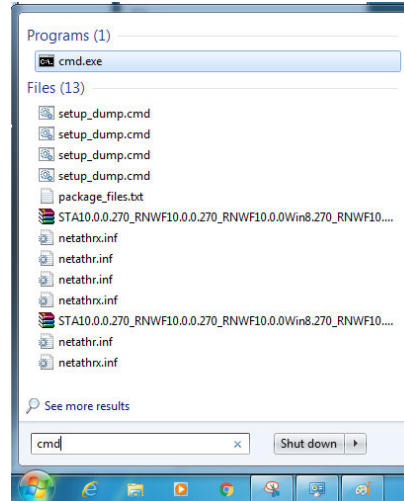
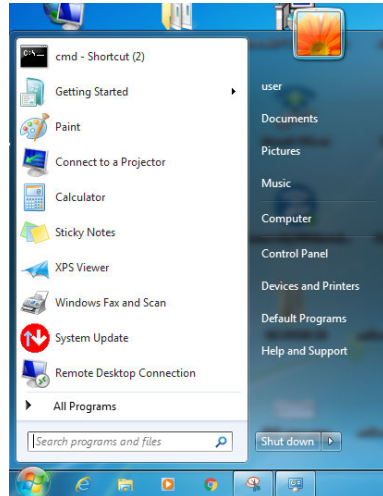
Using ping to test the physical link



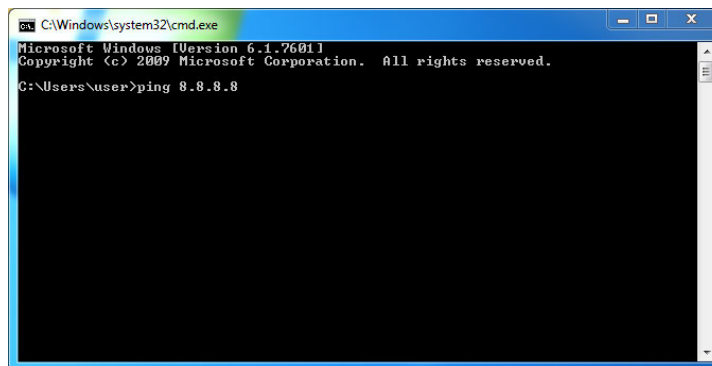
- Click on the Window icon on lower left.



- Type “**CMD**” in to the Search program and file column

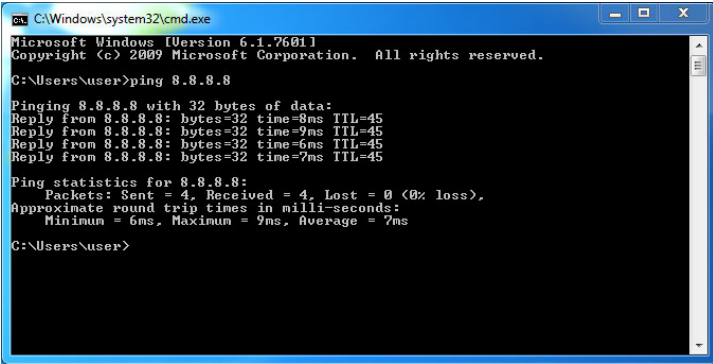


- Ping 8.8.8.8 in the CMD window. It is ping the google server.



- The physical link connection is established between the device and google server, if the ping has reply from 8.8.8.8.





```

C:\Windows\system32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\Users\User>ping 8.8.8.8

Pinging 8.8.8.8 with 32 bytes of data:
Reply from 8.8.8.8: bytes=32 time=8ms TTL=45
Reply from 8.8.8.8: bytes=32 time=9ms TTL=45
Reply from 8.8.8.8: bytes=32 time=6ms TTL=45
Reply from 8.8.8.8: bytes=32 time=7ms TTL=45

Ping statistics for 8.8.8.8:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 6ms, Maximum = 9ms, Average = 7ms

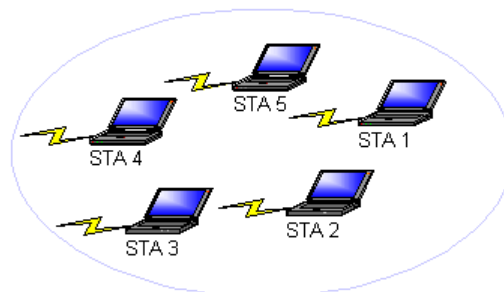
C:\Users\User>

```

- The wireless network adaptor now is set up completely and working properly. Your device should be able to connect to the wireless world.

## 10. Ad Hoc Connection

In an ad hoc mode WLAN (wireless local-area network), wireless devices can communicate directly with each other. A wireless network adapter works within an independent basic service set (IBSS), as illustrated here. All stations communicate directly with other stations without using an access point (AP). If you have a Windows 7 computer (or a Windows Vista computer, which is very similar), you will use a process similar to the following to create and activate your ad hoc WLAN network. Please be noticed that only **“Computer to Computer”** connection at this mode, no internet connection.



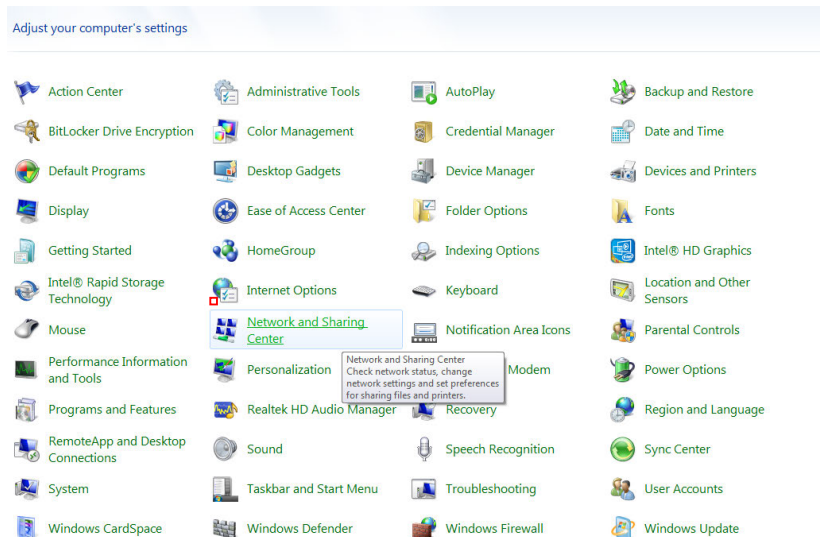


## 10-1. Setting up Ad Hoc

- (viii) Click **“Start”** and choose **“Control Panel”**.

This opens the Control Panel window.

- (ix) Select **“Network and Sharing Center”**.



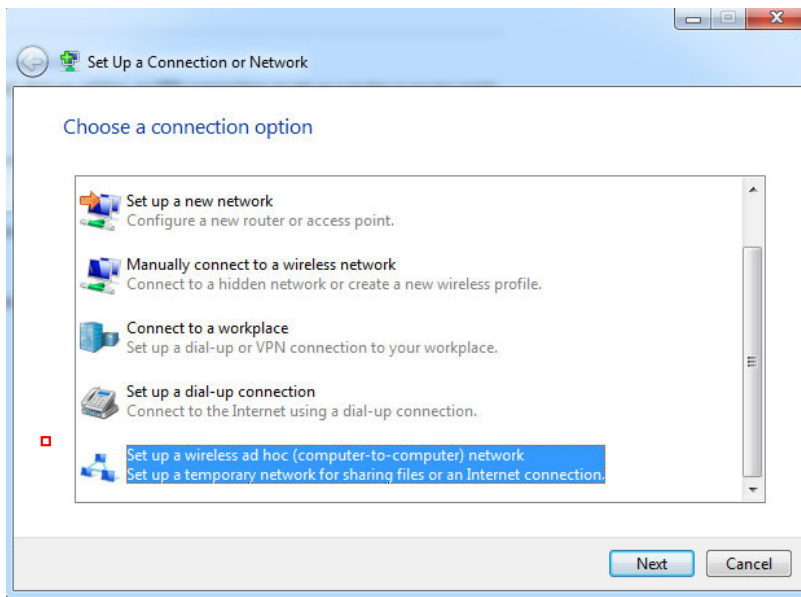
- (x) From the Network and Sharing Center window, select **“Set Up a New Connection or Network”** and select **“Next”**.

This sets up a Connection or Network dialog box appears.

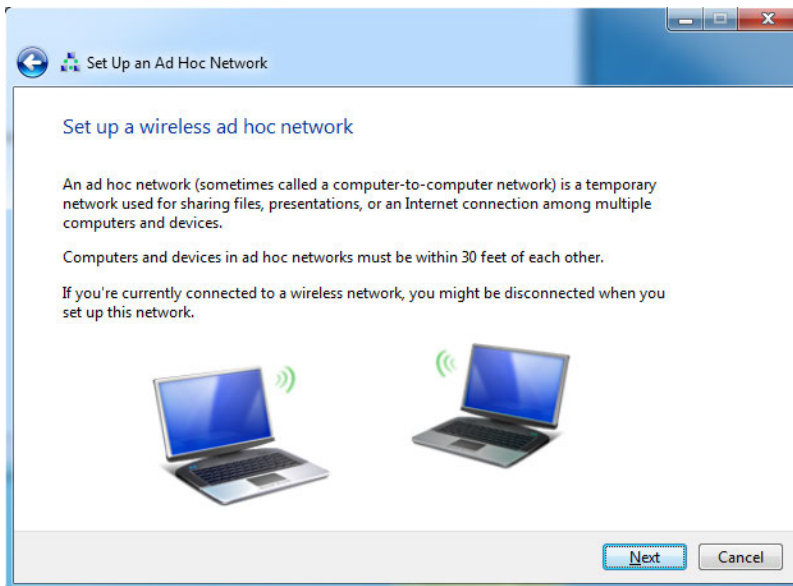
- (xi) From the **“Set Up a Connection or Network”** dialog box, choose **“Set Up a Wireless Ad Hoc (Computer-to-Computer) Network”** and click **“Next”**.

This sets up an Ad Hoc Network dialog box appears.





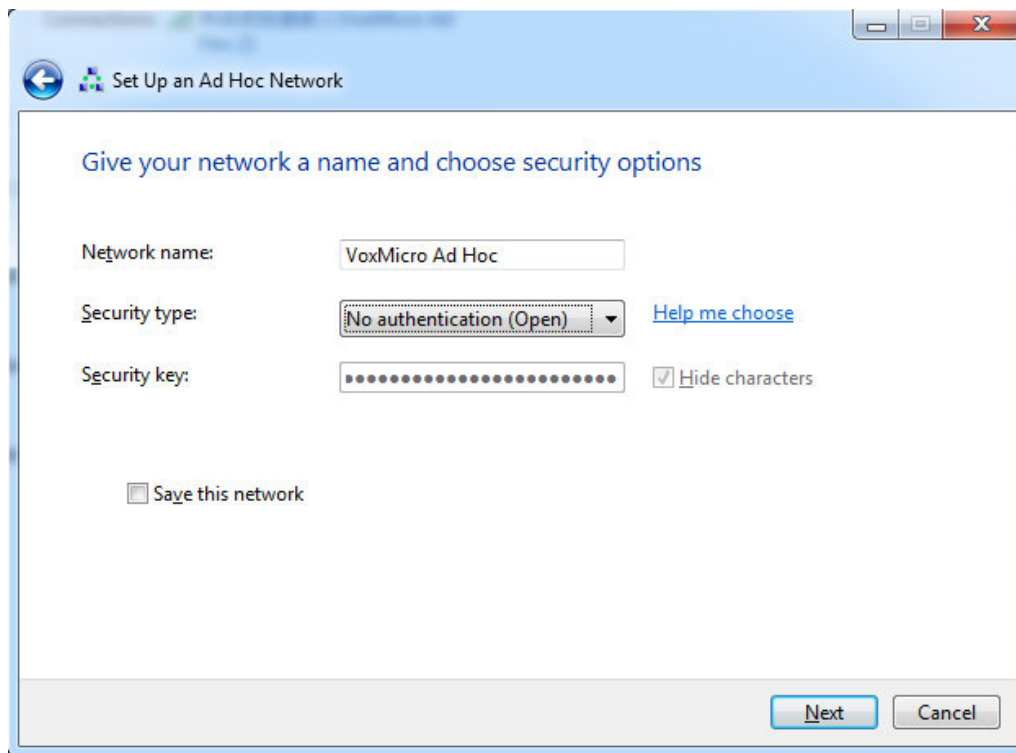
(xii) In the “**Set Up an Ad Hoc Network**” dialog box, provide the following information:



- Add a network name for your wireless network.
- Indicate the security type as either WEP or No Authentication.



- If you chose WEP, provide the security key for the network and optionally select the Hide Characters box.
  - Select Save This Network to keep this network for longer than one session.
  - Click “**Next**” to continue.
- (xiii) The confirmation dialog is displayed, showing you the information that you need to provide to other people who will want to connect to your ad hoc network. Close the window.

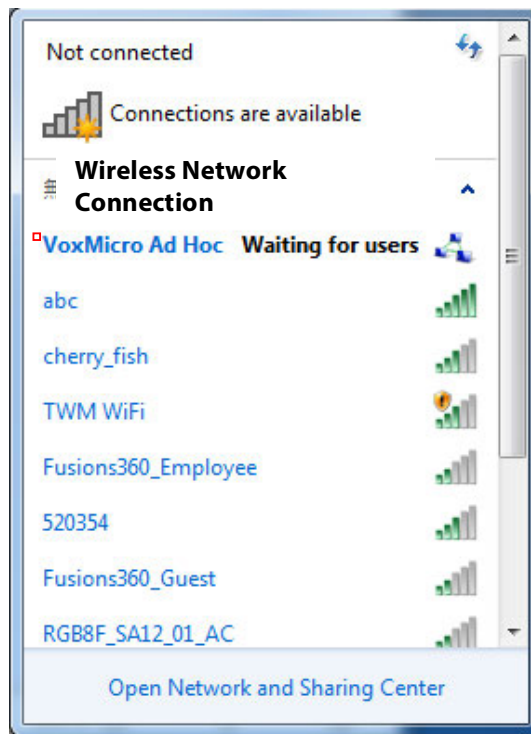


- (xiv) Select below signal indicator, you should be able to see available wireless connections.





(xv) You will see the Ad Hoc connection is waiting for user to connect.

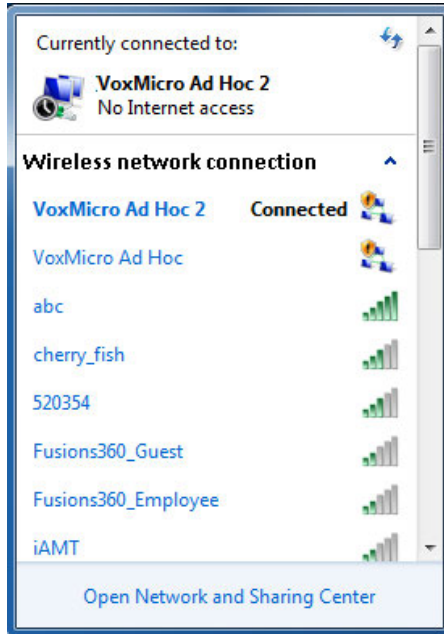


### 10-2. Ad Hoc Connection establishment

(xvi) Select the wireless signal indicator from other computer that you want to have the peer to peer connection



- (xvii) Select the Ad Hoc connection that you want to connect to and select “**Connection**”.



- (xviii) Peer to peer connection is established



After the connection is set up, it initially becomes active and remains so until you connect to another network. If you did not choose to save the connection, it will be removed from your wireless configuration at that time and you will need to repeat this process to reactivate an ad hoc network connection.

### 10-3. Disconnect Ad Hoc connection

Repeat 7.2 process and select the Ad Hoc connection, the “**Disconnect**” will appear instead of “**Connect**”. Select “**Disconnect**” and the Ad Hoc connection will be disconnected.

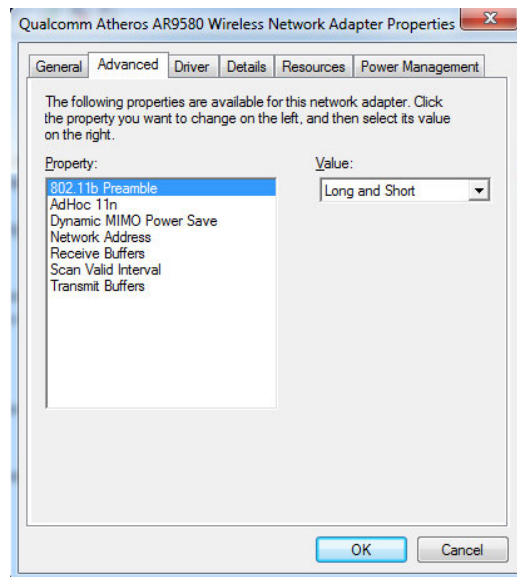
## 11. Advanced Settings

There are several advanced WiFi settings that can be changed. They are advanced WiFi settings which are normally set to default value. These advanced network adapter settings can vary between different models and drivers. These settings can significantly affect performance and reliability—in a good or bad way. Though some settings and adjustments are supposed to help, they almost always depend upon your particular network and usage. A re-install of the driver should restore the factory defaults if there is a need.

Again, you can go to below location and right click on the wireless Network adaptor. You can see the advance features on the second tab.

Star > Control Panel > Device Manage > Network adaptor





You can change the setting by selecting the particular item and change the value on the right. Click the “OK” when you are done with the change.

### **802.11b Preamble**

Most wireless 802.11b devices are preset for long preambles. This allows increased compatibility between wireless devices, sometimes at the expense of speed. All wireless 802.11b devices must support long preambles, while short preambles are optional. The 802.11b protocol, for example, allows switching from a short preamble to long and back again to remedy difficulties in data transmission between devices.

### **Ad Hoc 11n**

This will enable or disable the computer to computer connection feature.

### **Dynamic MIMO Power Saving**

Dynamic MIMO power save is used by 802.11n radios for power saving across multiple tx-rx chains. Running multiple radio chains increases power consumption, and also increase the achievable data rate by a larger amount. However, it is not useful to have all chains available all the time. So, this mechanism is useful in shutting unused chains



to conserve power. So, for example if a receiver is only receiving beacons from an AP and not doing anything else, running two chains will not be useful.

### **Network Address**

This will setup the network address.

### **Receive Buffers**

The buffer size of system memory that can be used by the adapter for received packets, which can be increased to help improve the performance of outgoing network traffic, but it consumes system memory.

### **Scan Valid Internal**

The amount of time (in seconds) before the client starts scanning for a better access point after reaching the roaming threshold or missing beacons. (See Table 1 for the threshold criteria.) The higher the value, the less time the client spends scanning for a better access point and the more time it has to send data

### **Transmit Buffers**

The buffer size of system memory that can be used by the adapter for sending packets, which can be increased to help improve the performance of outgoing network traffic, but it consumes system memory.

## **12. Regulatory Compliance Notice - FCC**

### **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.

Operations in the 5.15-5.25GHz band are restricted to indoor usage only.



**Radiation Exposure Statement:**

The product complies with the FCC portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available.

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 & the user's body.

**Note:** The separation distance between any two antennas for all testing configuration must be 9 cm.

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

- (i) The antenna must be installed such that 20 cm is maintained between the antenna and users, and the transmitter module may not be co-located with any other transmitter or antenna.
- (ii) As long as 2 conditions above are met, further transmitter test may not be required, but OEM is expected to perform some testing to ensure continued compliance in the new host configuration, but further certification filing is not necessary. The OEM installer is responsible for continued compliance.
- (iii) This device has been designed to operate with a series of antennas. Those are listed below and have a maximum gain of 3.0 dBi for 2.4 GHz and 5.0 dBi for 5.0 GHz when adjusted for the cable and insertion losses as assessed. Antennas having a higher gain are strictly prohibited per regulatory compliance rules. The required antenna impedance is 50 ohms. Under regulatory compliance, this radio transmitter



may only operate using an antenna of the below indicated types with maximum (or lesser) gain as approved by the regulatory certification body. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (E.I.R.P.) is not more than that necessary for successful communication.

No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain (dBi)
1	WAE-ISO3	OxfordTec	Omni-directional	2.4GHz	1.2
				5GHz	2.5
2	WAND2DBI-SMA	OxfordTec	Omni	2.4GHz	2.0
				5GHz	3.0
3	WAND5DBI-SMA	OxfordTec	Dipole	2.4GHz	3.0
				5GHz	5.0
4	WAPH-2DBI-26 (Integrated Antenna)	OxfordTec	PCB Antenna	2.4GHz	2.0
				5GHz	2.5

### IMPORTANT NOTE:

In the event that these conditions cannot 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 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

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:



2AE3B-AEX-AR95X". 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, including the statement below:

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.

## **13. Regulatory Compliance Notice – ISED Canada**

This device complies with RSS-247 of the Industry Canada 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.

Ce dispositif est conforme à la norme CNR-247 d'Industrie Canada applicable aux appareils radio exempts de licence. Son fonctionnement est sujet aux deux conditions suivantes: (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.



**Radiation Exposure Statement:**

The product complies with the Canada portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available.

**Déclaration d'exposition aux radiations:**

Le produit est conforme aux limites d'exposition pour les appareils portables RF pour les Etats- Unis et le Canada établies pour un environnement non contrôlé.

Le produit est sûr pour un fonctionnement tel que décrit dans ce manuel. La réduction aux expositions RF peut être augmentée si l'appareil peut être conservé aussi loin que possible du corps de l'utilisateur ou que le dispositif est réglé sur la puissance de sortie la plus faible si une telle fonction est disponible.

**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 et votre corps.

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



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:

L'antenne doit être installée de telle sorte qu'une distance de 20 cm est respectée entre l'antenne et les utilisateurs, et

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 cannot 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 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 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: 20662-AEXAR95X".

**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 20 cm 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: 20662-AEXAR95X".

**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, including the statement below:

This equipment complies with Industry Canada 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.

### **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, y compris le rapport ci-dessous:

Ce matériel est conforme aux limites d'exposition de rayonnement d'Industrie Canada déterminées pour un environnement non contrôlé. Ce matériel devrait être installé et actionné avec la distance minimum 20cm entre le radiateur.

### **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 bands 5250-5350 MHz and 5470-5725 MHz shall comply with the E.I.R.P. limit; and





- (iii) the maximum antenna gain permitted for devices in the band 5725-5825 MHz shall comply with the E.I.R.P. limits specified for point-to-point and non point-to-point operation as appropriate.
- (iv) Users should also be advised that high-power radars are allocated as primary users (i.e. priority users) of the bands 5250-5350 MHz and 5650-5850 MHz and that these radars could cause interference and/or damage to LE-LAN devices.

### **Avertissement:**

Le guide d'utilisation des dispositifs pour réseaux locaux doit inclure des instructions précises sur les restrictions susmentionnées, notamment :

- (iv) les dispositifs fonctionnant dans la bande 5 150-5 250 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;
- (v) le gain maximal d'antenne permis pour les dispositifs utilisant les bandes 5 250-5 350 MHz et 5 470-5 725 MHz doit se conformer à la limite de P.I.R.E.;
- (vi) le gain maximal d'antenne permis (pour les dispositifs utilisant la bande 5 725-5 825 MHz) doit se conformer à la limite de P.I.R.E. spécifiée pour l'exploitation point à point et non point à point, selon le cas.
- (vii) 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 5250-5 350 MHz et 5 650-5 850 MHz et que ces radars pourraient causer du brouillage et/ou des dommages aux dispositifs LAN-EL.

This device has been designed to operate with a series of antennas. Those are listed below and have a maximum gain of 3.0dBi when adjusted for the cable and insertion losses as assessed. Antennas having a higher gain are strictly prohibited per regulatory compliance rules. The required antenna impedance is 50 ohms. Under regulatory compliance, this radio transmitter may only operate using an antenna of the below indicated types with maximum (or lesser) gain as approved by the regulatory certification body. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (E.I.R.P.) is not more than that necessary for successful communication.

This radio transmitter (IC: 20662-AEXAR95X / Model: AEX-AR95 SERIES) has been approved by Industry Canada to operate with the antenna type, maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this user's manual, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Ce dispositif a été conçu pour fonctionner avec une antenne ayant un gain maximal de antenne avec dBi [3.0]. Une antenne à gain plus élevé est strictement interdite par les règlements d'Industrie Canada. L'impédance d'antenne requise est de 50 ohms.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.)



ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante

Le présent émetteur radio (IC: 20662-AEXAR95X / Model: AEX-AR95 SERIES) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

## 14. Regulatory Compliance Notice - NCC

第十二條 經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

第十四條 低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

本模組於取得認證後將依規定於模組本體標示審合格籤，並要求平台上標示「本產品內含射頻模組：XXXXXXXXXX」

在 5.25-5.35 赫茲(GHz)頻帶內操作之無線資訊傳輸設備，限於室內使用。



## 15. APPENDIX

### 13.1 Specifications

SOLUTION DESIGN	<b>Chipset</b>	Qualcomm-Atheros AR95 SERIES-AR1A (extended temperature version) / AR1B (industrial temperature version)
	<b>Standard</b>	IEEE 802.11 a/b/g/n Wi-Fi
	<b>Industrial Reference</b>	Qualcomm Atheros reference design XB116
APPEARANCE	<b>Communications Interface</b>	Mini PCIE format, PCI Express Standard 1.1 host I/O
	<b>Form Factor</b>	Mini PCIE format, standard mPCIe dimensions – Full size card
ANTENNA	<b>Configuration Type</b>	3 Streams (3 chains), 3x3, 3 Connectors, MIMO I-PEX / U.FL connectors
WIRELESS PARAMETERS	<b>Frequency Band</b>	WLAN: 2.4 GHz ISM Bands 2.412-2.472 GHz 5.15-5.25 GHz (FCC UNII-low band) for US/Canada, Japan and Europe 5.25-5.35 GHz (FCC UNII-middle band) for US/Canada and Europe 5.475-5.725 GHz for Europe 5.725-5.825 GHz (FCC UNII-high band) for US/Canada
	<b>Data Transfer Rates</b>	WLAN 2.4GHz: 11n: Up to 450Mbps(dynamic) 11g: Up to 54Mbps(dynamic) 11b: Up to 11Mbps(dynamic) WLAN 5GHz: 11n: Up to 450Mbps(dynamic) 11a: Up to 54Mbps(dynamic)
	<b>Media Access Control</b>	CSMA/CA with ACK
	<b>Channel</b>	2.4GHz: 1-11 for FCC and IC, 1-13 for Europe 5GHz (HT20): 36-48, 52-64, 100-140, 149-165 5GHz (HT40): 38-46, 54-62, 102-134, 151-159
	<b>Channel Spacing</b>	5MHz
	<b>Spreading / Modulation</b>	WLAN 802.11a/g/n: OFDM, BPSK, QPSK, 16-QAM, 64-QAM-DSSS: DBPSK, DQPSK, CCK 802.11b: CCK(11, 5.5Mbps), DQPSK(2Mbps), BPSK(1Mbps)



	<b>RF Output Power</b>	<p>802.11a: Typical 16.5 dBm at 6M +/- 2dBm (Average)                  802.11b: Typical 20 dBm +/- 2 dBm (Peak)                  802.11g: Typical 24.5 dBm at 6M +/- 2dBm (Peak)                  802.11n 5G HT20: Typical 15.5 dBm at MCS16 +/- 2dBm (Average)                  802.11n 5G HT40: Typical 13 dBm at MCS16 +/- 2dBm (Average)                  802.11n 2.4G HT20: Typical 22 dBm at MCS16 +/- 2dBm (Peak)                  802.11n 2.4G HT40: Typical 22 dBm at MCS16 +/- 2dBm (Peak)</p> <p>The three-chain combined output power equals to single chain power plus 5dB (3Tx = 1Tx + 5dB).</p>
	<b>RF Receive Sensitivity (Typical)</b>	<p>802.11a: 54M less than -81 dBm                  802.11b: 11M less than -94 dBm                  802.11g: 54M less than -81 dBm                  802.11n 2.4G: HT20 MCS7 less than -76 dBm                                    HT40 MCS7 less than -73 dBm                  802.11n 5G: HT20 MCS7 less than -76 dBm                                    HT40 MCS7 less than -71 dBm                                    VHT40 MCS8 less then -64 dBm                                    VHT40 MCS8 less then -61 dBm</p>
	<b>Operating Range</b>	Open Space: ~300 m; Indoor: ~100 m (The transmission speed may vary according to the environment)
	<b>Wireless Security</b>	WEP 64-bit and 128-bit encryption WPA (Wi-Fi Protected Access) WPA2 (Wi-Fi Protected Access)
WORKING MODES	Infrastructure, Client, Bridge, Ad-hoc	
SAFETY, EMISSION & REGULATORY	Compliant with FCC, CE and IC. Compliant with RoHS.	
PROTOCOLS	<b>IEEE WLAN Network</b>	802.11n, 802.11g, 802.11b, 802.11a, 802.11d, 802.11e, 802.11j and 802.11i
	<b>Other Standards</b>	
	<b>Industry Standards</b>	
HOST SYSTEM REQUIREMENTS	<b>Operating System</b>	WLAN: Windows (32 & 64 bits) XP/Vista/7/8, OSX, Linux
ENVIRONMENT	<b>Operating Temperature</b>	-40° ~ +85° Celsius
	<b>Storage Temperature</b>	-50° ~ +90° Celsius
	<b>Operating Humidity</b>	10%~90% non-condensing
	<b>Storage Humidity</b>	5%~95% non-condensing
ELECTRICAL	<b>I/O Voltage</b>	3.3V +/-10%
	<b>Power Consumption</b>	WLAN: Transmit Packet Test HT 40*: 900 mA Receiver Packet Test HT 40*: 260 mA



MECHANICAL	<b>Dimensions</b>	50.95 mm x 30mm x 3.15mm (with shielding)
	<b>Weight</b>	6.1 g
PACKAGING	<b>Packing style</b>	ESD Sleeves in Carton Box Package (optional: open plastic tray modality)
	<b>Package Contents</b>	AEH-AR95 Series IEEE 802.11 a/b/g/n mPCI-E modules

Channel	Frequency	Mode(s)	Scanning	Ad-Hoc support
1-11	2412 – 2462 MHz	802.11bgn (HT20)	Active	None
3-9	2422 – 2452 MHz	802.11n (HT40)	Active	None
12,13	2467, 2472 MHz	802.11bgn (HT20)	Channels are not supported	
10,11	2457, 2462 MHz	802.11n (HT40)		
36-48	5180-5240 MHz	802.11an (HT20)	Passive	None
38-46	5190-5230 MHz	802.11n (HT40)	Passive	None
52-64	5260-5320 MHz	802.11an (HT20)	Passive	None
54-62	5270-5310 MHz	802.11n (HT40)	Passive	None
100-140	5500-5700 MHz	802.11an (HT20)	Passive	None
102-134	5510-5670 MHz	802.11n (HT40)	Passive	None
149-165	5745-5825 MHz	802.11an (HT20)	Passive	None
151-159	5755-5795 MHz	802.11n (HT40)	Passive	None

This is the channel plan for devices marketed with the FCC ID on the label.

To comply with 15.202 requirements for client devices, the AEX-AR95 Series is programmed at the factory for a specific geographic location or region code. The wireless LAN operating parameters such as available channels and transmit power levels are set based on the region code. Periodic system software updates cannot change the region code and thus the wireless LAN parameters. The AEX-AR95 Series is protected with a cryptographic signature, which prevents the loading of unauthorized software.

### 13.2 802.11N

IEEE 802.11n is an amendment to IEEE 802.11-2007 as amended by IEEE 802.11k-2008, IEEE 802.11r-2008, IEEE 802.11y-2008, and IEEE 802.11w-2009, and builds on previous 802.11 standards by adding multiple-input multiple-output (MIMO) and 40 MHz channels to the



PHY (physical layer), and frame aggregation to the MAC layer.

MIMO is a technology that uses multiple antennas to coherently resolve more information than possible using a single antenna. One way it provides this is through Spatial Division Multiplexing (SDM), which spatially multiplexes multiple independent data streams, transferred simultaneously within one spectral channel of bandwidth. MIMO SDM can significantly increase data throughput as the number of resolved spatial data streams is increased. Each spatial stream requires a discrete antenna at both the transmitter and the receiver. In addition, MIMO technology requires a separate radio-frequency chain and analog-to-digital converter for each MIMO antenna, making it more expensive to implement than non-MIMO systems.

Channels operating with a width of 40 MHz are another feature incorporated into 802.11n; this doubles the channel width from 20 MHz in previous 802.11 PHYs to transmit data, and provides twice the PHY data rate available over a single 20 MHz channel. It can be enabled in the 5 GHz mode, or within the 2.4 GHz mode if there is knowledge that it will not interfere with any other 802.11 or non-802.11 (such as Bluetooth) system using the same frequencies. [3] The MIMO architecture, together with wider-bandwidth channels, offers increased physical transfer rate over 802.11a (5 GHz) and 802.11g (2.4 GHz).

When 802.11g was released to share the band with existing 802.11b devices, it provided ways of ensuring coexistence between legacy and successor devices. 802.11n extends the coexistence management to protect its transmissions from legacy devices, which include 802.11g, 802.11b and 802.11a. There are MAC and PHY level protection mechanisms as listed below:

- PHY level protection: Mixed Mode Format protection (also known as L-SIG TXOP Protection): In mixed mode, each 802.11n transmission is always embedded in an 802.11a or 802.11g transmission. For 20 MHz transmissions, this embedding takes care of the protection with



802.11a and 802.11g. However, 802.11b devices still need CTS protection.

- PHY level protection: Transmissions using a 40 MHz channel in the presence of 802.11a or 802.11g clients require using CTS protection on both 20 MHz halves of the 40 MHz channel, to prevent interference with legacy devices.

MAC level protection: An RTS/CTS frame exchange or CTS frame transmission at legacy rates can be used to protect subsequent 11n transmission.

### 13.3 Hardware installation

Module shall be well seated with screw, holder or glue within the system. The location shall be well designed. It should be distant from high voltage, heat, high noise area, so to achieve better wireless performance. Antennas location shall be away from the body at least 20 cm to minimize the power into the body.

Antenna location should be able to provide the best line-of-sight (LOS) of the system (normally near the top of the system for the client, or at the other way if it is a master) to achieve better performance for the system. All the antenna ports should be connected with antenna or terminator, so to avoid the damage and have better performance.

Below antennas are recommended. The antenna gain should be less than the one listed below in all directions for certification compliance purpose.

This radio transmitter (IC: 20662-AEXAR95X) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated.

Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.





No.↵	Antenna Part Number↵	Manufacture↵	Antenna Type↵	Frequency (MHz)↵	Max Gain (dBi)↵	Directional Gain (3T3R) (dBi)↵
1↵	WAE-ISO3↵	<u>OxfordTec</u> ↵	Dipole↵	2.4GHz↵	2.71↵	7.48↵
				5GHz↵	1.84↵	6.61↵
2↵	WAND2DBI-SMA↵	<u>OxfordTec</u> ↵	Dipole↵	2.4GHz↵	2.81↵	7.58↵
				5GHz↵	1.4↵	6.17↵
3↵	WAND5DBI-SMA↵	<u>OxfordTec</u> ↵	Dipole↵	2.4GHz↵	3.0↵	7.77↵
				5GHz↵	5.0↵	9.77↵
4↵	WAPH-2DBI-26↵ (Integrated Antenna)↵	<u>OxfordTec</u> ↵	PCB Antenna↵	2.4GHz↵	2.0↵	6.77↵
				5GHz↵	2.5↵	7.27↵



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