# AIRETOS® E63 Class

**Product: IEEE 802.11ax/ac/a/b/g/n WiFi with Bluetooth Module**

**ACB-QCA6391 Chip-on-Board Module based product with Qualcomm QCA639 on-board1and Xtal at 48MHz**

OPERATION MANUAL

DCN: 09A-CPD17-B1
Release Date: June 20, 2021

APPLIES TO MODEL NUMBERS: (1) ACB-QCA6391 (2) ACB-QCA6391-WX1 (3) ACB-QCA6391-WX2 (4) ACB-QCA6391-WX4 (5) ACB-QCA6391-WX5 (6) ACB-QCA6391-WI1 (7) ACB-QCA6391-WI2 (8) ACB-QCA6391-WI4 (9) ACB-QCA6391-WI5

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# Revision History

| Releases | Date | Notes |
|---|---|---|
| Version 1.0 | June 2021 | Initial Release |

# Table of Contents

# 1. Document Conventions

| | | |
|---|---|---|
| **TEXT CONVENTION** | **Bold** | Bold type within paragraph text indicates commands, file names, directory names, paths, output, or returned values.<br><br>Example: The DK_Client package will not function unless you use the wdreg_install batch file. |
| | *Italic* | Within commands, italics indicate a variable that the user must specify.<br><br>Example: *mem_alloc size_in_bytes*<br><br>Titles of manuals or other published documents are also set in italics. |
| | `Courier` | The Courier font indicates output or display.<br><br>Example: `Error: Unable to allocate memory for transfer!` |
| | Menu | The Menu character tag is used for menu items.<br><br>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.<br><br>Example: Start > Programs > DK > wdreg_install. |
| | “ ” | Within commend, items are in window menu selection. |
| **NOTICES** | | **NOTE:** 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 ACB-QCA6391SERIES 802.11ax/ac/abgn wireless network card. This wireless network adaptor has a Dual MAC connection for a theoretical maximum data transfer rate at 1774.5 Mbps, it also provides wide wireless coverage. This wireless network card supports Multi-User MIMO (Multi-In, Multi-Out) technology, which uses two different radio channels to enhance data transfer rate and wireless coverage.

## 2.1 Product Description

**Wi-Fi Key Features:**

- Dual Band Simultaneous (DBS) with dual MAC, up to 1774.5 Mbps dynamic data transfer rate at 2x2 (2.4GHz) + 2x2 (5GHz) 11ax DBS mode. Full 802.11ax/ac/abgn MU-MIMO two antenna Wi-Fi.
- 20/40 MHz channel bandwidth for 2.4 GHz and 20/40/80 MHz channel bandwidth for 5 GHz
- Seamless antenna sharing with LTE, LTE-U and 5G
- Dynamic Frequency Selection (DFS)
- Offloading traffic for minimal host utilization at 11ac/ax speeds
- Low power PCIe (w/L1 sub-state) interface
- Integrated close-loop power detector

**BT Key Features:**

- Bluetooth 5.2+ Milan with Class I mode, ANT+ and BLE. Backward-compatible to previous standards.
- Split ACL support for A2DP true stereo. Dual eSCO and dual A2DP streams.
- Flexible interface Slimbus/PCM/I2S/I2C for BT audio
- Virtual (soft) USB available for combined UART/PCM/I2S management

# 3. System Requirements

**Minimum Requirements:**

- 32-bit PCI Express Bus
- RAM: 1 GB
- Processor 1 GHz
- Hard disk space: 16 GB for 32-bit OS or 20 GB for 64-bit OS
- Graphics card: DirectX 9 or later with WDDM 1.0 driver
- Display resolution: 800 x 600
- Operating System; Latest version of Windows 10 OS

# 4. Preparation

This manual is demonstrating how to install the driver into a Windows 10 OS host. In this document, we will be using Windows 10 64bit version to demonstrate how to properly install the driver for the AIRETOS E63 Class.

## 4.1 Software

Make sure the driver package is fully downloaded and saved into a dedicated location (ex. **C:**).

The package of this driver should have the following files:

- Qualcomm_Atheros_QCA639x_Installer.exe
- setup.iss
- setup_uninstall.iss

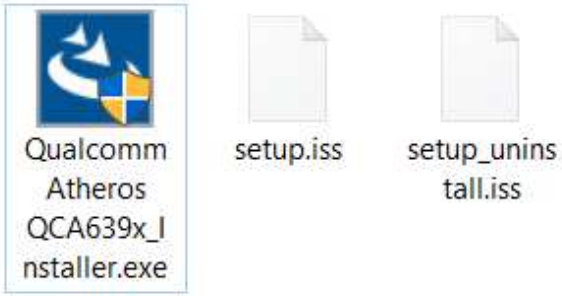
### 4.2 Hardware

Have the correct AIRETOS E63 adaptor for your system and ensure the product is not damaged. Install properly the adaptor at the system slot. Please be noticed that you should turn off the computer before the hardware installation. Once you have the hardware installed, you can start the diver installation process.

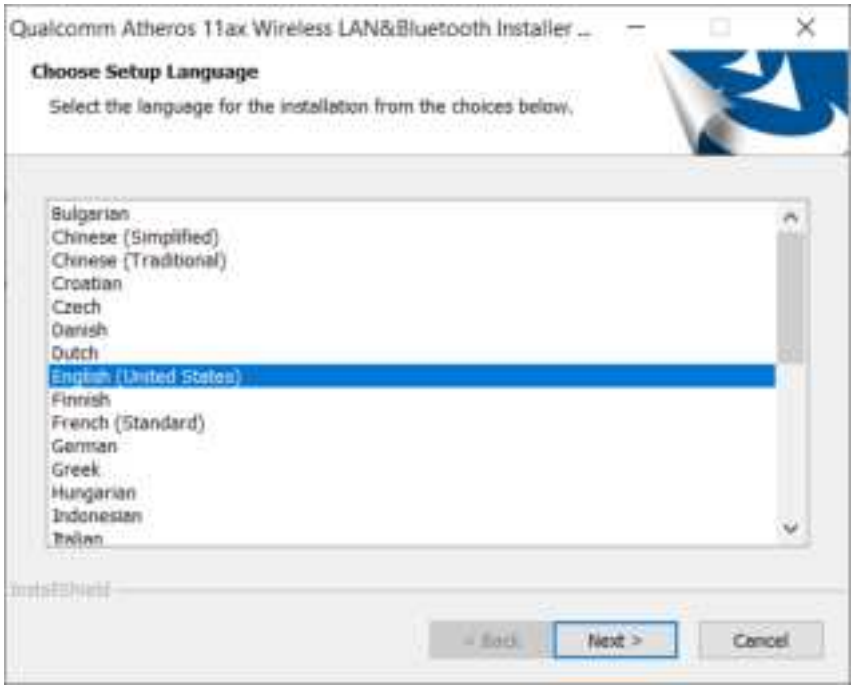
## 5. Windows Driver Installation / Uninstallation

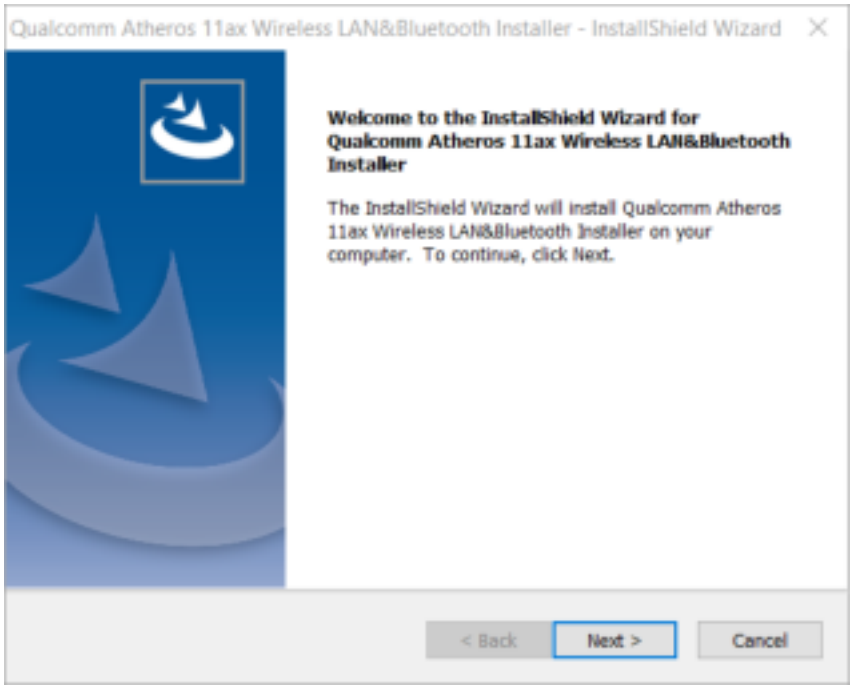
### 5.1 Windows Driver Installation

1. Double click on the installer executable file (exe file) "Qualcomm Atheros QCA639x_Installer.exe" to launch the installer.

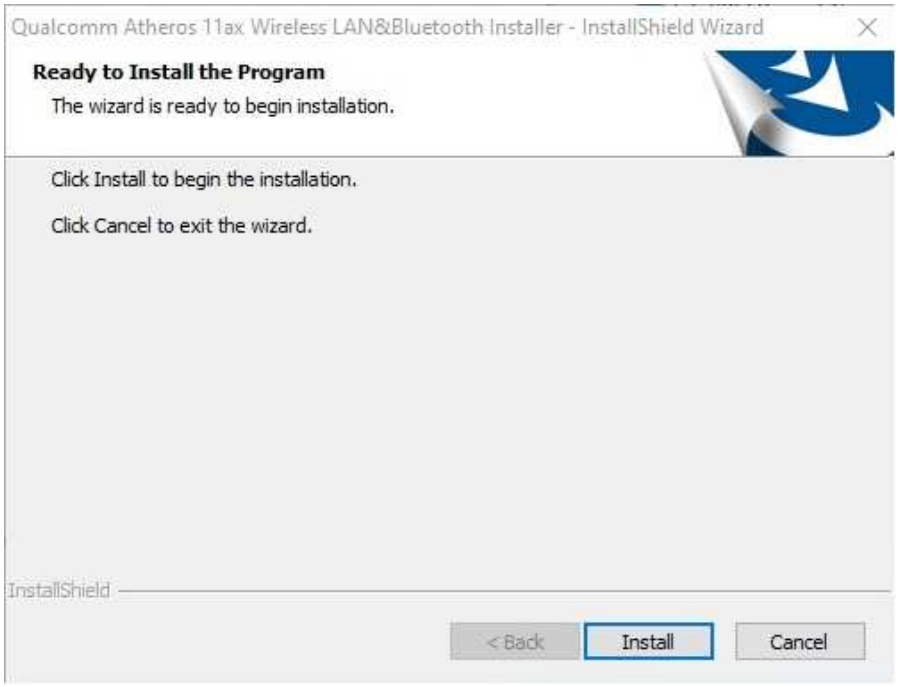


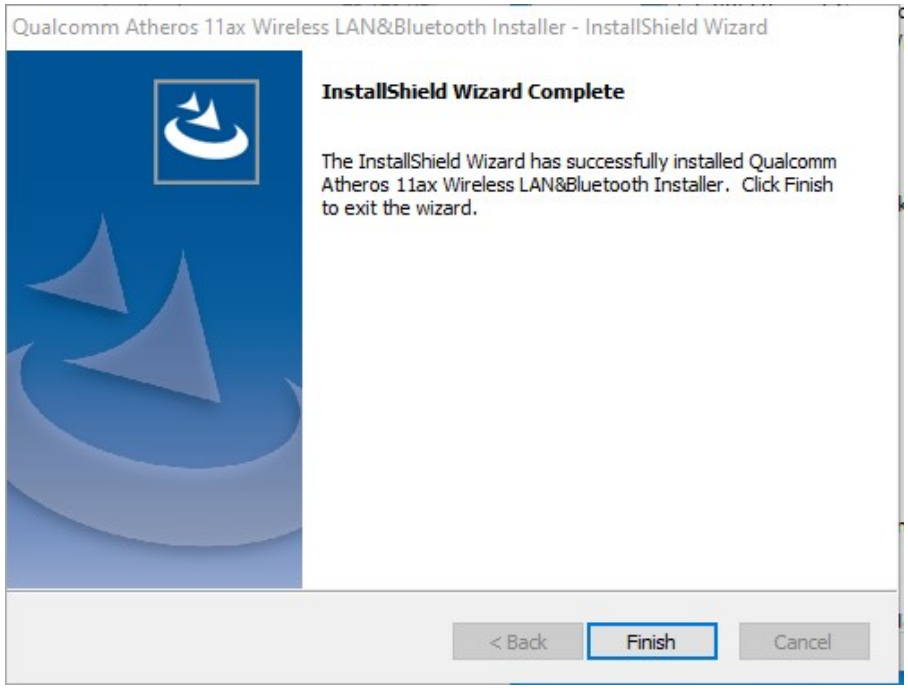
2. Walk through the installation process:
   - Choose preferred setup language, click next and wait for the InstallShield Wizard to prepare for setup. Click Next when done:



- After the preparation, the InstallShield Wizard is ready to install the driver. Click next and wait for the completion of the installation. Once done press on “Finish” to complete the installation.



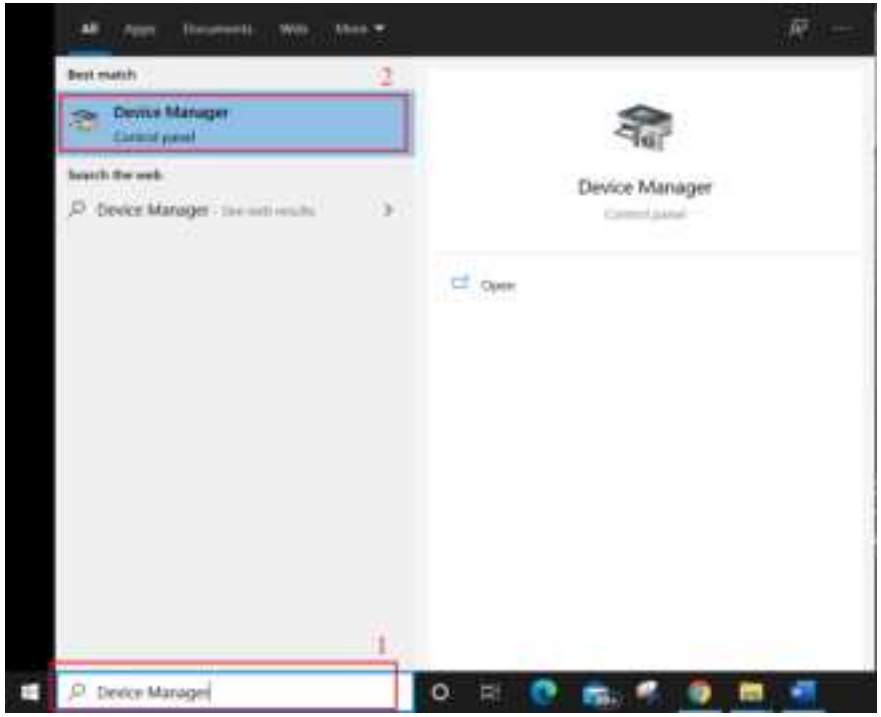




3. Restart your computer to apply changes.

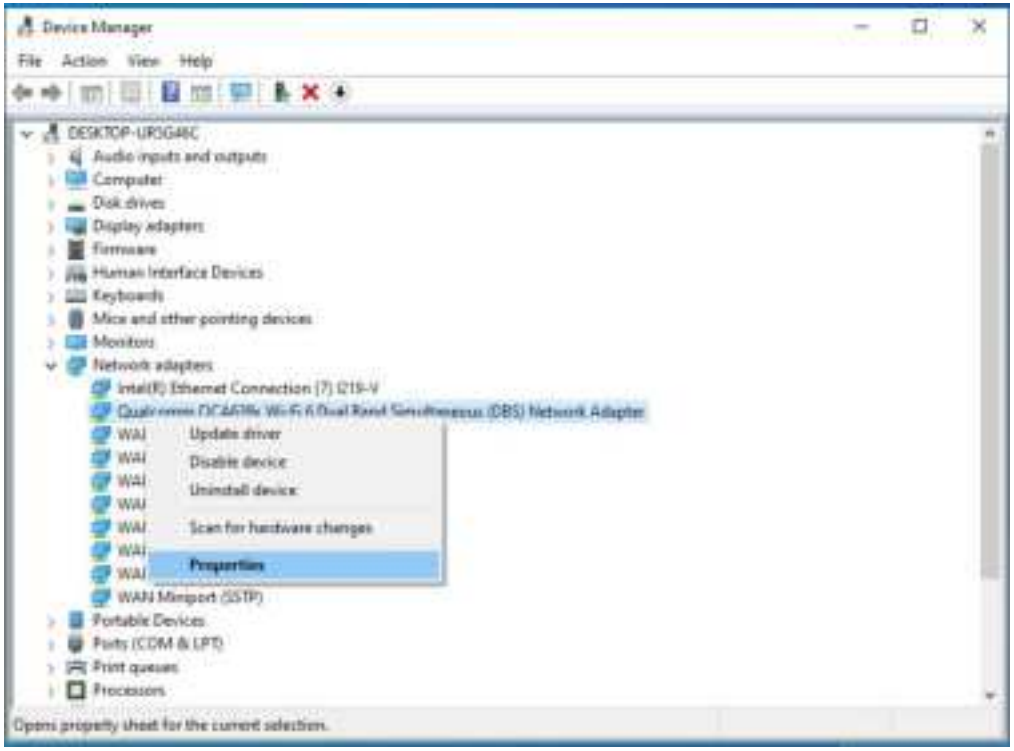
## 6. Driver Uninstallation

This section guides on how to uninstall the driver from your system.

1. To remove the driver from the OS, go to Device Manager, by clicking the search bar at the bottom left-hand side corner and type in "**Device manager**".



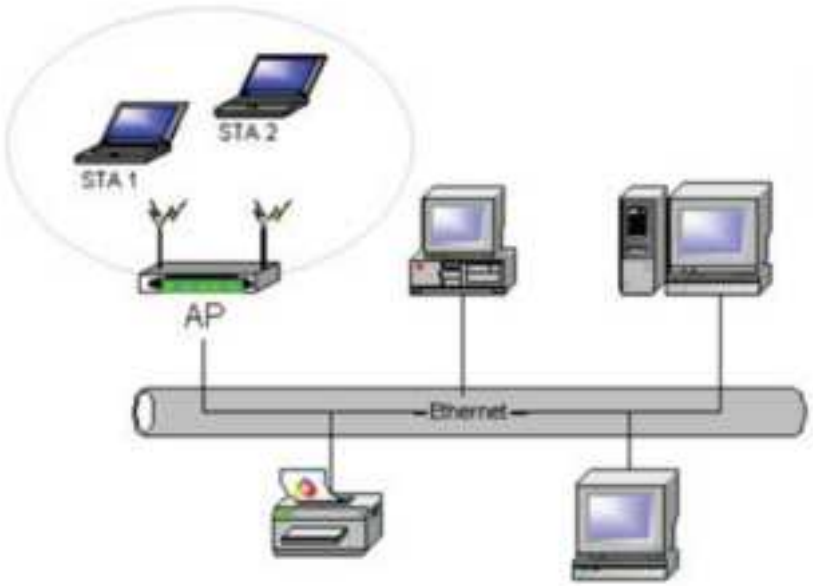
2. Right-click on "**Qualcomm QCA639x Wi-Fi 6 Dual Band Simultaneous (DBS) Network**" and choose Uninstall. Alternatively, the driver can be uninstalled in the properties window:




3. Click OK to uninstall the device

## 7. Connect to the internet

If the previous steps were successful then 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 below:




- When the installation of the device is completed, the wireless network adaptor will appear.

- Connect to a wireless network; click on the Wi-Fi symbol which is located at the bottom right-hand side of the screen. Then select and connect to the desired access point.

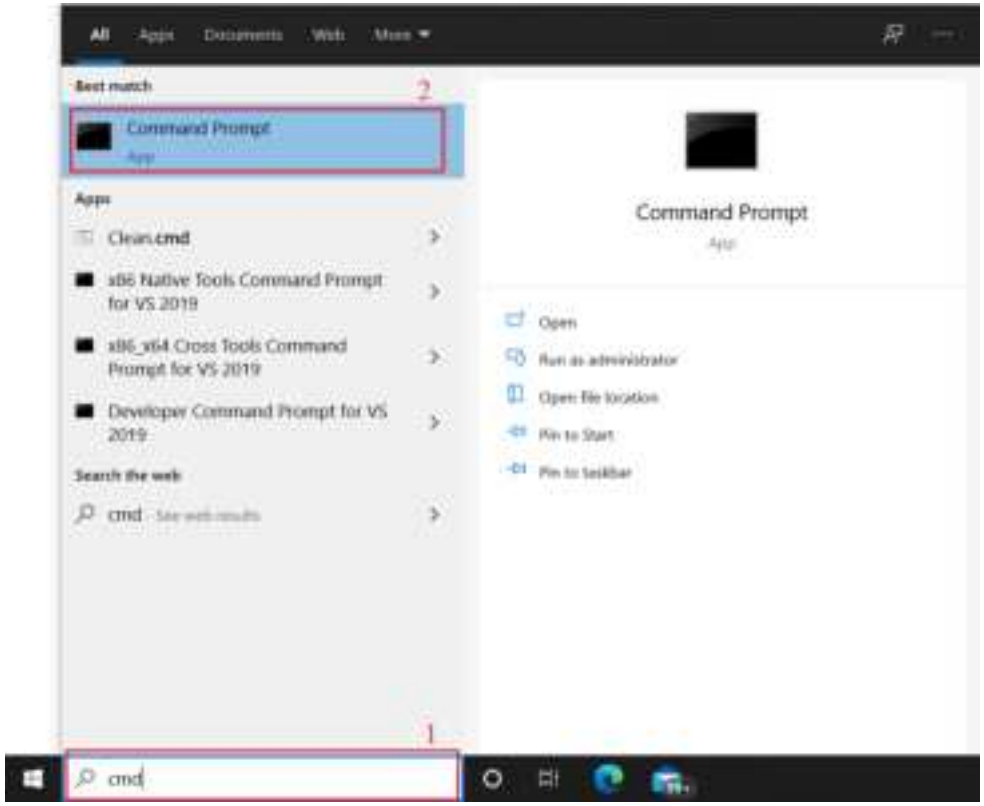

- Select the **"connect"** option and it will try to connect to the access point that has been selected.
- A hand-shake process will take place between the wireless adaptor and the access point.
- The connection between the computer and the access point will be established once the authentication and authorization have been confirmed.

## 8. Connection verification

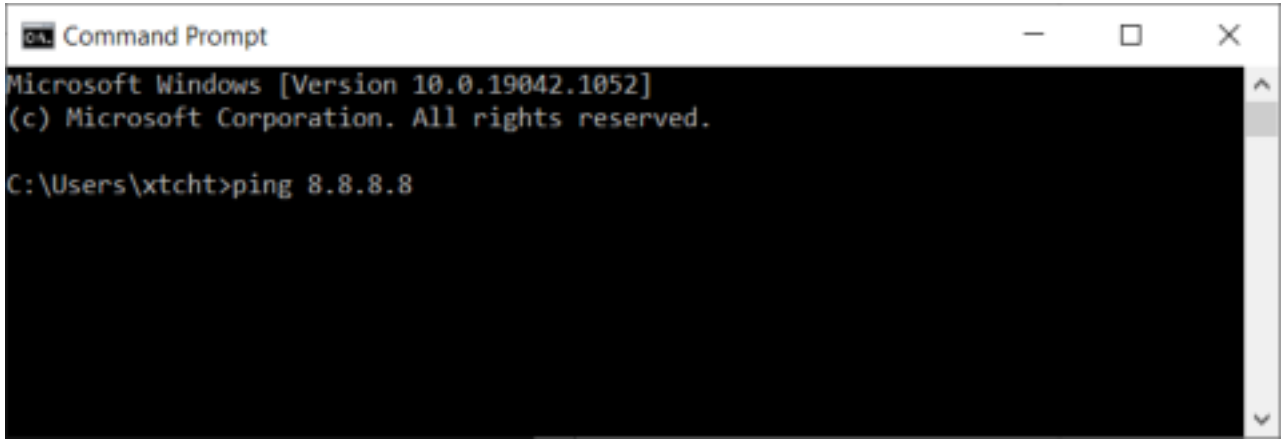
The device should have a connection with the access point. You can now connect to the internet cloud. Ping can be used for testing the physical link. For example, you can ping google IP using command prompt.

**Using ping to test the physical link**

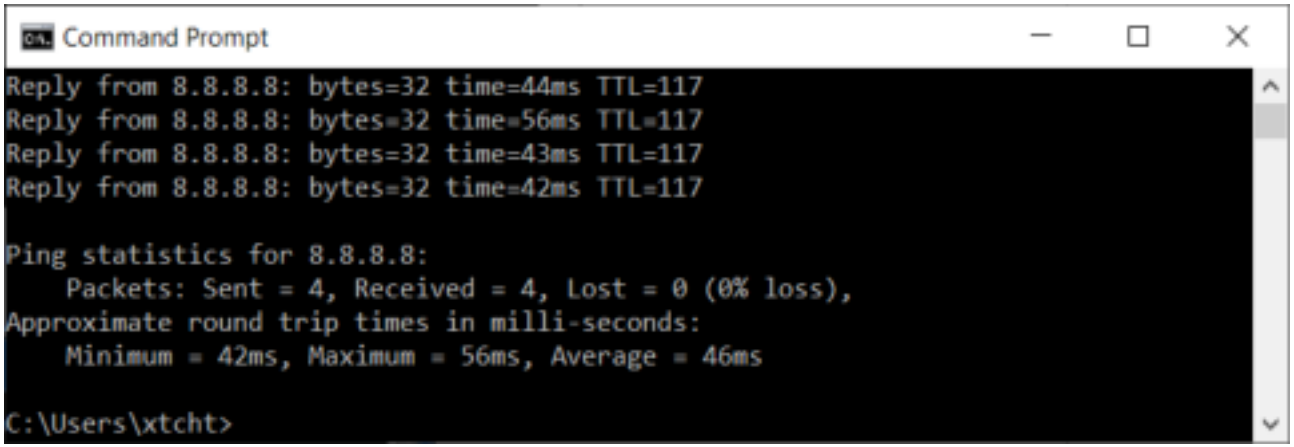
- Type "**CMD**" into the search bar located at the bottom left corner on Windows 10 and click on "**Command Prompt**":



- Ping 8.8.8.8 in the CMD window to ping the Googles server by typing "***ping 8.8.8.8***".




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




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

# 9. Regulatory Compliance Notice

**Federal Communication Commission Interference Statement:**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more 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.

Any changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

**RF exposure statements**

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

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body or nearby persons.

CFR 47 FCC PART 15 SUBPART C (15.247) and SUBPART E (15.407) has been investigated. It is applicable to the modular transmitter.

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

This radio transmitter2AE3B-ACB-QCA6391 has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Unique antenna connector must be used on the Part 15 authorized transmitters used in the host product.

| Antenna Type | Brand | Antenna Model | Maximum Gain (dBi) | |
|---|---|---|---|---|
| | | | 2.4 GHz | 5GHz |
| Chip | ethertronics | M830520 | 1 dBi | 2.6 dBi |
| FPC | OXFORDTEC | WAFH-2DBI-15 | 2.7 dBi | 2.6 dBi |
| Dipole | OXFORDTEC | WAND2DBI-SMA | 2 dBi | 3 dBi |
| Dipole | OXFORDTEC | WAND5DBI-SMA | 3 dBi | 5 dBi |
| PCB | OXFORDTEC | WAPH2DB4-15 | 2.18 dBi | 2.69 dBi |

Length of RF cable:150mm

Connector type of RF cable: I-PEX/MHF1 to RP-SMA(F)

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains Transmitter Module FCC ID:2AE3B-ACB-QCA6391” Or “Contains FCC ID:2AE3B-ACB-QCA6391”

The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

**Industry Canada statement:**

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

1) This device may not cause interference, and

2) This device must accept any interference, including interference that may cause undesired operation of the device.

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

1) l'appareil ne doit pas produire de brouillage;

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

Caution:

1) 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;

2) For devices with detachable antenna(s), the maximum antenna gain permitted for devices in the bands 5250-5350 MHz and 5470-5725 MHz shall be such that the equipment still complies with the e.i.r.p. limit;

3) For devices with detachable antenna(s), 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

Avertissement:

1) Le dispositif fonctionnant dans la bande 5150-5250 MHz est réservé uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux;

2) Le gain maximal d'antenne permis pour les dispositifs avec antenne(s) amovible(s) utilisant les bandes 5250-5350 MHz et 5470-5725 MHz doit se conformer à la imitation P.I.R.E.;

3) Le gain maximal d'antenne permis pour les dispositifs avec antenne(s) amovible(s) utilisant la bande 5725-5850 MHz doit se conformer à la limitation P.I.R.E spécifiée pour l'exploitation point à point et non point à point, selon le cas.

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.

This radio transmitter (IC: 20662-ACBQCA6391 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.

Le présent émetteur radio (IC: 20662-ACBQCA6391 a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés cidessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

| Antenna Type | Brand | Antenna Model | Maximum Gain (dBi) | |
|---|---|---|---|---|
| | | | 2.4 GHz | 5GHz |
| Chip | ethertronics | M830520 | 1 dBi | 2.6 dBi |
| FPC | OXFORDTEC | WAFH-2DBI-15 | 2.7 dBi | 2.6 dBi |
| Dipole | OXFORDTEC | WAND2DBI-SMA | 2 dBi | 3 dBi |
| Dipole | OXFORDTEC | WAND5DBI-SMA | 3 dBi | 5 dBi |
| PCB | OXFORDTEC | WAPH2DB4-15 | 2.18 dBi | 2.69 dBi |

If the ISED certification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains IC: 20662-ACBQCA6391”.

Si le numéro de certification ISDE n'est pas visible lorsque le module est installé à l'intérieur d'un autre appareil, alors l'extérieur de l'appareil dans lequel le module est installé doit également afficher une étiquette faisant référence au module inclus. Cette étiquette extérieure peut utiliser un libellé comme celui-ci: “ Contient IC: 20662-ACBQCA6391“.

Plaque signalétique du produit final:

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 20662-ACBQCA6391 ".

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 manue

Must use the device only in host devices that meet the FCC/ISED RF exposure category of mobile, which means the device is installed and used at distances of at least 20cm from persons.

The end user manual shall include FCC Part 15 /ISED RSS GEN compliance statements related to the transmitter as show in this manual.

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B, ICES 003.

Host manufacturer is strongly recommended to confirm compliance with FCC/ISED requirements for the transmitter when the module is installed in the host.

Must have on the host device a label showing Contains FCC ID: 2AE3B-ACB-QCA6391, Contains IC: 20662-ACBQCA6391

The use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer’s instruction manual.

If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

l'hôte doit utiliser l'instrument uniquement dans des dispositifs qui répondent à la fcc / (catégorie d'exposition rf mobile, ce qui signifie le dispositif est installé et utilisé à une distance d'au moins 20 cm de personnes.

le manuel de l'utilisateur final doit inclure la partie 15 / (fac rss gen déclarations de conformité relatives à l'émetteur que de montrer dans ce manuel.

le fabricant est responsable de la conformité de l'hôte, le système d'accueil avec le module installé avec toutes les autres exigences applicables du système comme la partie 15 b, ices - 003. accueillir le fabricant est fortement recommandé de confirmer la conformité avec les exigences de la fcc / (émetteur lorsque le module est installé dans l'hôte.

le dispositif d'accueil doivent avoir une étiquette indiquant contient FCC ID:2AE3B-ACB-QCA6391, contient IC : 20662-ACBQCA6391

OEM Integration Instructions:
This device is intended to only for OEM integrators under the following conditions:
The module can be used to installation in other host.
The antenna(s) used for this transmitter must be installed to the provided separation distance of at least 20 cm from all the persons and must not be co-located or operating in conjunction with any other antenna or transmitter test will not be required.
The module shall be only used with the integral antenna(s) that has been originally tested and certificated with this module.
As long as 3 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 requirement with this module installed.
This module is designed for Client Device only

取得審驗證明之低功率射頻器材，非經核准，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。低功率射頻器材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。前述合法通信，指依電信管理法規定作業之無線電通信。低功率射頻器材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。

應避免影響附近雷達系統之操作。

高增益指向性天線只得應用於固定式點對點系統。

# 10. Appendix

## Specifications

### Solution Design

- Chipset

  Qualcomm- ACB-QCA6391

- Standard

  IEEE 802.11ax Wi-Fi 6 plus Bluetooth 5.2 Combo, full backwards compatibility to previous standards

- Industrial Reference
  - Based on Qualcomm Atheros Hastings reference design

### Appearance

- Communications Interface
  - WLAN: via PCI Express Standard 2.1 host I/O
  - BT: via HCI UART and I2S (Virtual-USB mapping at SW level); PCM and I2C are available
- Form Factor
  - SMD, Chip-on-Board, Soldered, Stamp down, Solder down “SIP type”, 2826 (28mm x 26m)

### Antenna

- Configuration
  - Three Streams (2 chains), 2x2, 2 Connectors, MIMO
- Type
  - Three on-board U.Fl. connector receptables

**Wireless Parameters**

- Frequency Band

WLAN:
- GHz ISM Bands 2.412-2.462 GHz
- 5.15-5.25 GHz (FCC UNII-low band) for US/Canada, Japan and Europe 5.25-5.35 GHz (FCC UNIImiddle band) for US/Canada and Europe 5.47-5.725 GHz for Europe
- 5.725-5.825 GHz (FCC UNII-high band) for US/Canada

BT:
- 2402MHz~2480MHz

- Data Transfer Rates

WLAN:
- 802.11ax: Up to 1774.5Mbps (dynamic)
- 802.11ac: Up to 867Mbps (dynamic)
- 802.11n: Up to 300Mbps (dynamic)
- 802.11a/g: Up to 54Mbps (dynamic)
- 802.11b: Up to 11Mbps (dynamic)

BT:
- GFSK at 1Mbp
- π/4-DQPSK at 2Mpbs
- 8DPSK at 3Mpbs

- Media Access Control
  - CSMA/CA with ACK
- Channel
  - 2.4GHz: 1-11
  - 5GHz: 36-48 149-165
- Channel Spacing
  - 5MHz, 10MHz, 20 MHz, 40Mhz selectable for 2.4Ghz band. 80Mhz is also available for the 5Ghz band.
- Spreading / Modulation

WLAN: 802.11ax: OFDMA (BPSK, adds 1024-QAM on MCS10 and MCS11)
802.11ac/g/n: OFDM (BPSK, DSSS-OFDM, QPSK,16-QAM,64-QAM, 256-QAM), MRC, STBC, LDPC, ML Demodulation
802.11b: CCK (11, 5.5Mbps), DQPSK (2Mbps), BPSK (1Mbps)

BT: GFSK, π/4-DQPSK, 8DPSK

- RF Receive Sensitivity (Typical, 1x1 chain)
  - 802.11b 11M less than 91 dBm
  - 802.11g 54M less than 77 dBm
  - 802.11a 54M less than 77 dBm
  - 802.11n/ax 2.4G V/HT20 MCS7 less than 77 dBm 95 dBm at MCS0
  - 802.11n/ax 2.4G V/HT40 MCS7 less than 73.5 dBm 92.5 dBm at MCS0
  - 802.11ax 2.4G VHT20 MCS9 less than 71.5 dBm, MCS11 less than 64 dBm 94.5 dBm at MCS0
  - 802.11ax 2.4G VHT40 MCS9 less than 68 dBm, MCS11 less than 62 dBm 92 dBm at MCS0
  - 802.11n/ac/ax 5G V/HT20 MCS7 less than 77 dBm 95 dBm at MCS0
  - 802.11n/ac/ax 5G V/HT40 MCS7 less than 74.5 dBm 92.5 dBm at MCS0
  - 802.11ax 5G V/HT20 MCS9 less than 70 dBm, MCS11 less than 64 dBm 85 dBm at MCS0
  - 802.11ax 5G V/HT40 MCS9 less than 68 dBm, MCS11 less than 62 dBm 85 dBm at MCS0
  - 802.11ax 5G V/HT80 MCS9 less than 62 dBm, MCS11 less than 59 dBm 85 dBm at MCS0
  - BT: BER < 0.1% (Anritsu 8852B Tx -83Bm)
- Operating Range
  - Open Space: ~300 m; Indoor: :~100 m (The transmission speed may vary according to the environment)
- Wireless Security
  - WEP 64-bit and 128-bit encryption
  - WPA/WPA2/WPA3 UL/DL (Wi-Fi Protected Access)

**Modalities**

- Infrastructure, AP/STA, Client, Bridge, Mixed-mode, P2P/Ad-hoc

**Safety & Regulatory**

- Compliant with FCC, CE RED, ISED, Japan TELEC and more.
- Compliant with RoHS3.

**Protocol**

- IEEE WLAN Network

- 802.11ax, 802.11ac, 802.11n, 802.11g, 802.11b, 802.11a, 802.11d, 802.11e, 802.11h, 802.11i, 802.11k, 802.11r, 802.11u, 802.11v and 802.11w.

- Other Standards
- Industry Standards

**Host System Requirements**

- Operating System
  - Android/Linux Closed Source, Android/Linux Open Source, Qualcomm Embedded Platform, Windows, MacOS

**Environment**

- Operating Temperature
  - -25º ~ +75º Celsius
- Storage Temperature
  - -45º ~ +135º Celsius
- Operating Humidity
  - 10%~90% non-condensing
- Storage Humidity
  - 5%~95% non-condensing

**Electrical**

- Power Consumption
  - Electronic current values in milliampere. Readings retrieved under stable, typical current and voltage.
  - Power consumption ratings are statistical maximums in test system setups which are placed in continuous operating modes.
  - Real-life application system power budgets are dependent on traffic mix, environment, topology and domain configuration.

**Mechanical**

- Dimensions
  - 28mm x 26mm x 2.35mm (with shielding)

- Weight
  - 4.2 g

**Packing**

- Packing style
  - ESD Sleeves in Carton Bulk Package (Optional Tray or Reel Packaging)
- Package Contents
  - Module only