

# Panasonic

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## Panasonic Avionics Corporation

### RD-CWAP2G User Manual

QCA9990 2.4G 4x4 b/g/n MIMO Mini PCIe Card

(Model : M120000016)

**Rev. 1.0**  
**2017/03/21**

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## Table of Content

|                                      |          |
|--------------------------------------|----------|
| <b>1. PRODUCT OVERVIEW .....</b>     | <b>1</b> |
| 1.1. GENERAL DESCRIPTION .....       | 1        |
| 1.2. FEATURES .....                  | 1        |
| <b>2. SOFTWARE ARCHITECTURE.....</b> | <b>5</b> |
| <b>3. REVISION HISTORY.....</b>      | <b>7</b> |

# 1. Product Overview

## 1.1. General Description

The document describes the hardware specification of 4Tx4R 802.11 b/g/n single band WIFI module. The device is built in Qualcomm QCA9990 which is a highly integrated wireless local area network (WLAN) system-on-chip (SoC) for 2.4GHz 802.11n WLAN applications. The QCA9990 integrates an on-board CPU for low-level setup of WLAN physical layer (PHY) and RF to offload the host processor for other tasks. It enables high-performance 4x4 MIMO with four spatial streams for wireless applications demanding the highest robust link quality and maximum throughput and range. The device integrates a multi-protocol MAC, PHY, analog-to-digital/digital-to-analog converters (ADC/DAC), 4x4 MIMO radio transceivers, and PCI Express interface in a PCBA for low power consumption and small form-factor applications.

## 1.2. Features

- ☐ High performance up to 600 Mbps data rate
- ☐ PCIe interface full card
- ☐ IEEE 802.11 b/g/n Wireless LAN Standards compliant
- ☐ MMCX connector
- ☐ Support 2.4GHz Band 4T x 4R MIMO
- ☐ Compatible OS with Linux

|                       |                                                                                                                                                                 |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Standard              | IEEE 802.11b/g/n                                                                                                                                                |
| Data Rate             | 54, 48, 36, 24, 18, 12, 9, 6, 11, 5.5, 2, 1<br>20 MHz BW: 6.5M~288M<br>40 MHz BW: 13.5M~600M                                                                    |
| Modulation            | DSSS with DBPSK and DQPSK, CCK modulations with long and short preamble.<br>OFDM with BPSK, QPSK, 16QAM, and 64QAM modulations, QPSK, 16QAM, 64QAM modulations. |
| Operating Frequencies | 2.4GHz- form 2.412 to 2.4835 GHz                                                                                                                                |
| Antenna Connectors    | Four antennas allowing transmission or reception on simultaneously                                                                                              |

## **2. Software architecture**

The device implements QCA9990 integrating half-duplex OFDM, CCK, and DSSS PHY, supporting 802.11n up to 288 Mbps for 20 MHz and 600 Mbps for 40 MHz channel operations, and IEEE 802.11 b/g/n data rates. Additional features include explicit transmit beamforming (TxBF), 802.11 compatible implicit TxBF, MIMO features, Maximal Likelihood (ML) decoding, Low-Density Parity Check (LDPC), Maximal Ratio Combining (MRC), Space Time Block Code (STBC), and On-Chip One-Time programmable (OTP) memory to eliminate the need for an external flash and to further reduce the external component count and BOM cost with integrated power management. The device supports 802.11 wireless MAC protocol, 802.11i security, Wi-Fi offload, error recovery, and 802.11e quality of service (QoS).

### 3. Revision History

| Revision | Date       | By Whom                       | Remark       |
|----------|------------|-------------------------------|--------------|
| 1.0      | 03/21-2017 | Bessel.Huang<br>/Jimmyin.Chen | ▪ Initialize |
|          |            |                               | ▪            |
|          |            |                               | ▪            |

## **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 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 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.

### **IMPORTANT NOTE:**

#### **Radiation Exposure Statement:**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

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

Country Code selection feature to be disabled for products marketed to the US/CANADA

Operation of this device is restricted to indoor use only

#### **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,
- 3) For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change.

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 requirements required with this module installed

**IMPORTANT NOTE**

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

**End Product Labeling**

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains FCC ID: U6Y-M120000016".

**Manual Information to the End User**

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

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

**Industry Canada statement:**

This device complies with Industry Canada's licence-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, même si le brouillage est susceptible d'en compromettre le fonctionnement.

**Radiation Exposure Statement:**

This equipment complies with 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.

**Déclaration d'exposition aux radiations:**

Cet équipement est conforme Canada limites d'exposition aux radiations dans un environnement non contrôlé. Cet équipement doit être installé et utilisé à distance minimum de 20cm entre le radiateur et votre corps.

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

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

As long as 1 condition 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:**

- 1) Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

Tant que les 1 condition ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

**IMPORTANT NOTE:**

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer



considered valid and the IC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

#### **NOTE IMPORTANTE:**

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

#### **End Product Labeling**

The final end product must be labeled in a visible area with the following: "Contains IC: 216P-M120000016".

#### **Plaque signalétique du produit final**

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 216P-M120000016".

#### **Manual Information To the End User**

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

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

#### **Manuel d'information à l'utilisateur final**

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

| Antenna info. |           | Peak gain ( dBi ) | Manufacture |
|---------------|-----------|-------------------|-------------|
| Type          | Connector | 2400~2483.5MHz    | -           |
| PIFA (1)      | MMCX      | 4.2               | Lynware     |
| PIFA (2)      | MMCX      | 4.2               |             |
| PIFA (3)      | MMCX      | 4.3               |             |
| PIFA (4)      | MMCX      | 4.2               |             |



|    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|
| BR | BG | CZ | DK | DE | EE | IE | EL | ES | FR |
| HR | IT | CY | LV | LT | LU | HU | MT | NL | AT |
| PL | PT | RO | SI | SK | FI | SE | UK |    |    |