802.11ac WiFi Module

Model Number: 802C2447

PRODUCT SPECIFICATION

Document revision history

Revision	Date	Approved by	Remarks
Version 1.0	2019-03-04		

FCC Warning

This device complies with part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliancecould void the user's authority to operate the equipment.

NOTE: 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 differentfrom that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

To maintain compliance with FCC's RF Exposure guidelines, This equipment should be installed and operated with minimum distance between 20cm the radiator your body: Use only the supplied antenna.

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) This device and its antenna(s) must not be co‑located with any other transmitters except inaccordance with FCC multi‑transmitter product procedures. Referring to the multi‑transmitterpolicy, multiple‑transmitter(s) and module(s) can be operated simultaneously without C2P.

3) For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4Gband, CH36 to CH48 and CH 149 to CH165 for 5.2G&5.8G band by supplied firmware programming tool. OEM shall not supply any tool or info to theend‑user regarding to Regulatory Domain change.

USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to be informed to keep at least 20cmseparation with the antenna while this end product is installed and operated. The end user has to beinformed that the FCC radio‑frequency exposure guidelines for an uncontrolled environment can beatisfied. The end user has to also be informed that any changes or modifications not expresslyapproved by the manufacturer could void the user's authority to operate this equipment.

If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement isrequired to be available in the users manual: This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmfulinterference and (2) this device must accept any interference received, includinginterference that may cause undesired operation.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " Contains FCCID:LNQ802C2447". If the size of the end product is larger than 8x10cm, then the followingFCC part 15.19 statement has to also be available on the label: This device complies with Part 15of FCC rules. Operation is subject to the following two conditions: (1) this device may not causeharmful interference and (2) this device must accept any interference received, includinginterference that may cause undesired operation.

1. General Description

This document is to specify the product requirements for 802.11a/b/g/n/ac PCI-e Module. This Card is based on Celeno CL2447 chipset that is a highly integrated 802.11ac wave2 AC/BBP and 2.4GHz/5GHz switchable RF chip with 4 spatial streams and a smart 4R4T antenna system. CL2447 introduces several new paradigm shifting concepts, yet to be seen in the high-performance Wi-Fi arena to-date. The CL2447 incorporates Software-Defined-Radio design, enabling MAC & PHY functionality evolution in-field, thus introducing real future-ready IEEE 802.11ac-wave2 capability. Further, the CL2447 introduces a unique host-offload engine, enabling a cost-effective, feature-rich wireless connectivity with un-matched performance offload from its host.

Integrated Spectrum Analysis and Management engine, enable unmatched interference-resiliency and whole-spectrum visibility for enhanced network performance and powerful Radio Resource Management engine. CL2447 is capable of full-spectrum analysis while in service without affecting performance.

Optimized RF architecture and baseband algorithms provide superb performance. Intelligent MAC design deploys a high efficient DMA engine and hardware data processing accelerators without overloading the host processor. The CL2447 is designed to support standard based features in the areas of security, quality of service and international regulation, as well as above standard integrated value-add functionalities based on Celeno's feature-rich OptimizAIR™ suite, giving end users the greatest performance anytime in any circumstance, while enabling OEMs and service providers airtime management capabilities for enhanced services.

2. Features

- □Compatible with IEEE 802.11a standard to provide wireless 54Mbps date rate.
- □Compatible with IEEE 802.11g standard to provide wireless 54Mbps date rate.
- □Compatible with IEEE 802.11b standard to provide wireless 11Mbps date rate.
- □Compatible with IEEE 802.11n standard to provide wireless 450Mbps date rate.
- □Compatible with IEEE 802.11ac standard to provide wireless 1300Mbps date rate.
- □Operation at 2.4~2.4835GHz, 5150~5250 and 5725~5850 frequency band to meet worldwide regulations
- □Provides simple legacy and 20MHz/40MHz/80MHz co-existence mechanisms to ensure backward andnetwork compatibility.
- □Supports infrastructure networks via Access Point and ad-hoc network via peer-to-peer communication
- □Supports IEEE 802.11i(WPA and WPA2), WAPI, enhanced security
- □Friendly user configuration and diagnostic utilities
- □PCIe 2.0 interface, Mini PCIe
- □ ROHS compliant

3. General Requirements

3.1 IEEE 802.11b Section

	Feature	Detailed Description
3.1.1	Standard	● IEEE 802.11b
3.1.2	Radio andModulation Schemes	● DQPSK, DBPSK, DSSS, and CCK
3.1.3	OperatingFrequency	● 2400~2483.5 MHz ISM band
3.1.4	Channel Numbers	● 11 channels for United States ● 13 channels for Europe Countries
3.1.5	Data Rate	● 11,5.5,2,and 1Mbps
3.1.6	Media AccessProtocol	● CSMA/CA with ACK

3.2 IEEE 802.11g Section

	Feature	Detailed Description
3.2.1	Standard	● IEEE 802.11g
3.2.2	Radio andModulation Type	● QPSK , BPSK , 16QAM ,64QAM with OFDM
3.2.3	OperatingFrequency	● 2400~2483.5MHz ISM band
3.2.4	Channel Numbers	● 11 channels for United States ● 13 channels for Europe Countries
3.2.5	Data Rate	● 6,9,12,18,24,36,48,54Mbps
3.2.6	Media AccessProtocol	● CSMA/CA with ACK

3.3 IEEE 802.11a Section

	Feature	Detailed Description
3.3.1	Standard	● IEEE 802.11a
3.3.2	Radio andModulation Type	● QPSK , BPSK , 16QAM ,64QAM with OFDM
3.3.3	OperatingFrequency	● 5.15~5. 25GHz and 5.725~5.850GHz
3.3.4	Channel Numbers	●9 non-overlapping channels
3.3.5	Data Rate	● 6,9,12,18,24,36,48,54Mbps
3.3.6	Media AccessProtocol	● CSMA/CA with ACK

3.4 IEEE 802.11n Section

<table>
<tr><th></th><th>Feature</th><th>Detailed Description</th></tr>
<tr><td>3.4.1</td><td>Standard</td><td>● IEEE 802.11n</td></tr>
<tr><td>3.4.2</td><td>Radio and Modulation Type</td><td>● QPSK , BPSK , 16QAM ,64QAM with OFDM</td></tr>
<tr><td>3.4.3</td><td>OperatingFrequency</td><td>●2.4GHz band:2400 ~ 2483.5MHz
● 5GHz band: 5.15~5. 25GHz and 5.725~5.850GHz</td></tr>
<tr><td>3.4.4</td><td>Data Rate (Mbps)</td><td>
<table>
<tr><td rowspan="2">MCS</td><td colspan="2">GI=800ns</td><td colspan="2">GI=400ns</td></tr>
<tr><td>20MHz</td><td>40MHz</td><td>20MHz</td><td>40MHz</td></tr>
<tr><td>0</td><td>6.5</td><td>13.5</td><td>7.2</td><td>15</td></tr>
<tr><td>7</td><td>65</td><td>135</td><td>72.2</td><td>150</td></tr>
<tr><td>15</td><td>130</td><td>270</td><td>144.4</td><td>300</td></tr>
<tr><td>23</td><td>195</td><td>405</td><td>216.7</td><td>450</td></tr>
</table>
</td></tr>
<tr><td>3.4.5</td><td>Media Access Protocol</td><td>● CSMA/CA with ACK</td></tr>
</table>

3.5 IEEE 802.11ac Section

<table>
<tr><th></th><th>Feature</th><th>Detailed Description</th></tr>
<tr><td>3.5.1</td><td>Standard</td><td>● IEEE 802.11ac</td></tr>
<tr><td>3.5.2</td><td>Radio and Modulation Type</td><td>● QPSK , BPSK , 16QAM ,64QAM,256QAM with OFDM</td></tr>
<tr><td>3.5.3</td><td>OperatingFrequency</td><td>●5GHz :5.15~5. 25GHz and 5.725~5.850GHz</td></tr>
<tr><td>3.5.4</td><td>Data Rate (Mbps)</td><td>
<table>
<tr><td rowspan="2">NSS/MCS</td><td colspan="3">GI=800ns</td><td colspan="3">GI=400ns</td></tr>
<tr><td>20MHz</td><td>40MHz</td><td>80MHz</td><td>20MHz</td><td>40MHz</td><td>80MHz</td></tr>
<tr><td>NSS1/MCS0</td><td>6.5</td><td>13.5</td><td>29.3</td><td>7.2</td><td>15</td><td>32.5</td></tr>
<tr><td>NSS1/MCS8</td><td>78</td><td>162</td><td>351</td><td>86.7</td><td>180</td><td>390</td></tr>
<tr><td>NSS1/MCS9</td><td></td><td>180</td><td>390</td><td></td><td>200</td><td>433.3</td></tr>
<tr><td>NSS2/MCS0</td><td>13</td><td>27</td><td>58.5</td><td>14.4</td><td>30</td><td>65</td></tr>
<tr><td>NSS2/MCS8</td><td>156</td><td>324</td><td>702</td><td>173.3</td><td>360</td><td>780</td></tr>
<tr><td>NSS2/MCS9</td><td></td><td>360</td><td>780</td><td></td><td>400</td><td>866.7</td></tr>
<tr><td>NSS3/MCS0</td><td>19.5</td><td>40.5</td><td>87.8</td><td>21.7</td><td>45</td><td>97.5</td></tr>
<tr><td>NSS3/MCS9</td><td>260</td><td>540</td><td>1170</td><td>288.9</td><td>600</td><td>1300</td></tr>
</table>
</td></tr>
<tr><td>3.5.5</td><td>Media Access Protocol</td><td>● CSMA/CA with ACK</td></tr>
</table>

4. Electrical and Thermal Characteristics

4.1 Temperature Limit Ratings

Parameter	Minimum	Maximum	Units
Storage Temperature	-55	+125	℃
Ambient Operating Temperature	**0**	**70**	℃
Junction Temperature	**0**	**125**	℃

4.2 General Section

	Feature	Detailed Description
5.2.1	Antenna Type	● PCB PIFA Antenna
5.2.2	Operating Voltage	● 3.3V±10%
5.2.3	Current Consumption	● ＜1000mA
5.2.4	Form Factor and Interface	●**PCIe interface**

4.3 Software

Driver：Linux, Android

4.4 Antenna Information

	PCB PIFA ANTENNA	
	2.4G	5G
Ant 0	4.7dBi	5.5dBi
Ant 1	3.7dBi	5.6dBi
Ant 2	3.6dBi	5.6dBi

4.5 Crystal information: TCXO TXO992025-STO-4143

Center Frequency：40MHz +/-2.5ppm

Operating Temperature: -30~85 degree C

Load Capacitance: 10pF

Supply Voltage: 1.8~3.3V

4.6 Mechanical Dimensions

Pin	Definition	Pin	Definition
1	PCIE_WAKE_L	22	PCIE_RESETn
2, 24, 39, 41, 52	VD33	23	PCIE_TX0_M
3, 5, 6, 8, 17, 19, 20, 28, 30, 32, 36, 38, 44, 46, 48	NC	25	PCIE_TX0_P
4, 9, 15, 18, 21, 26, 27, 29, 34, 35, 37, 40, 43, 50	GND	31	PCIE_RX0_M
7	CLKREQn	33	PCIE_RX0_P
10, 12, 14, 16, 45, 47, 49, 51	VDDA5_PA	42	5GL_EN_1295
11	REFCK_M		
13	REFCK_P