



WLE1216V5-20-I

Wi-Fi 5 (802.11ac Wave 2) Single-Band Wireless Module

Hardware User Guide

Wi-Fi 5 / 802.11ac
5GHz Single Band

QCA9994
Qualcomm Atheros 'Cascade'

MiniPCle Interface
PCIe 2.0 Compatible

4×4 MU-MIMO
Up to 1733 Mbps

Contents

1. Introduction	3
2. Package Contents	4
3. Hardware Overview.....	5
3.1 Module Layout.....	5
3.2 Connector Descriptions.....	6
3.3 Hardware Pinouts.....	7
4. Radio Module Specifications	8
4.1 Wi-Fi Capability	8
4.2 Notes & Recommendations	8
5. Mechanical Specifications	9
5.1 Module Dimensions.....	9
5.2 Environmental Ratings.....	9
5.3 Mounting & Installation Notes	9
6. Power Specifications	10
6.1 Power Requirements.....	10
6.2 Power Delivery Protection.....	10
6.3 Notes & Recommendations	10
7. Installation & Integration	11
7.1 Pre-Installation Checklist	11
7.2 Module Installation	11
7.3 Power Connection.....	11
7.4 Antenna Connection.....	11
8. Troubleshooting.....	12
9. Safety Precautions.....	13
10. Technical Support.....	14
11. Full Specifications	15
12. Regulatory Information.....	16

1. Introduction

Thank you for choosing the Compex WLE1216V5-20-I. This document provides complete hardware integration guidance for engineers and system developers deploying the WLE1216V5-20-I Wi-Fi 5 wireless module in embedded, industrial, and networking platforms.

The WLE1216V5-20-I is a single-band Wi-Fi 5 (802.11ac) wireless module based on the Qualcomm Atheros QCA9994 'Cascade' series chipset. Built on the Qualcomm Atheros CUS260 reference design, the module delivers 4×4 MU-MIMO operation in the 5GHz band through a standard MiniPCIe (PCIe 2.0) host interface.

Key Highlights

- Qualcomm Atheros QCA9994 'Cascade' Series chipset.
- 5GHz, 4×4 MU-MIMO, up to 1733 Mbps physical data rate.
- IEEE 802.11ac compliant; backward compatible with 802.11a/n devices in the 5GHz band.
- MiniPCIe interface with PCIe 2.0 host connectivity.
- Based on the Qualcomm Atheros CUS239 reference design.
- Heatsink design allows free air operation.
- Supports up to 256-QAM modulation; 4 spatial streams (4SS) at 80MHz and 2SS at 80+80MHz.
- Operating temperature: -40°C to 85°C (Industrial Grade). Storage: -40°C to 90°C.
- FCC, IC & CE RED Certified; REACH and RoHS compliant for global deployment.

2. Package Contents

Verify the following items are included in the package before proceeding with installation:

Checklist

- 1 × WLE1216V5-20-I Wi-Fi 5 wireless module

⚠ Note: External antennas (U.FL pigtail cables), host carrier board, and power supply are not included unless specified in the order. Contact sales@compex.com.sg for accessory options.

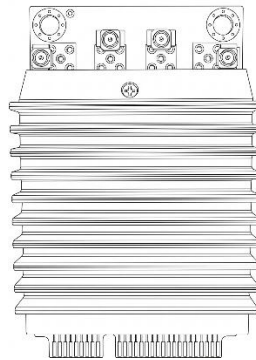
If any item is missing or damaged, contact Compex Technical Support (see Chapter 10) before proceeding.

3. Hardware Overview

The WLE1216V5-20-I is a radio-only Wi-Fi 5 module designed to be installed into a host platform's MiniPCle slot. To install on another slot such as an M.2 key slot, an M.2 key to MiniPCle adapter may be used. All wireless baseband and RF processing is handled onboard the module; the host platform supplies power and exchanges data over the PCIe 2.0 interface.

3.1 Module Layout

The WLE1216V5-20-I features the following major components and connectors:

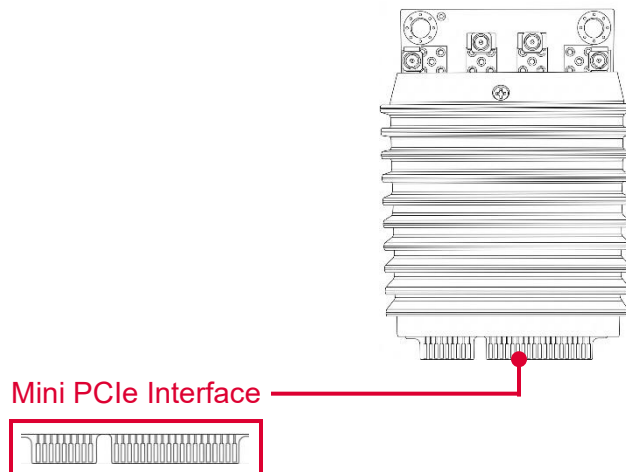


Chipset	Qualcomm Atheros QCA9994 'Cascade' Series
Reference Design	Qualcomm Atheros CUS239
Host Interface	MiniPCle Interface with PCIe 2.0
RF Connectors	4× U.FL Connectors (CH0, CH1, CH2, CH3)
System Memory	256Kbit serial I ² C bus EEPROM
Dimensions (W × H × D)	29.9mm × 50.8mm × 12.9mm

3.2 Connector Descriptions

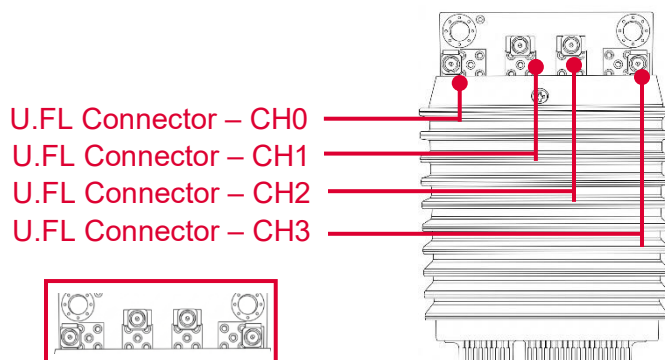
MiniPCle Edge Connector

- Standard MiniPCle (PCIe 2.0) edge connector along the bottom edge of the module.
- Carries PCIe data lanes, 3.3V power input, ground, and control signals to the host platform.



U.FL RF Connectors

- 4× U.FL Connectors (CH0, CH1, CH2, and CH3) located at the top edge of the module.
- CH0, CH1, CH2, and CH3 jointly support 4×4 MU-MIMO operation in the 5GHz band.
- Connect suitable external antennas rated for the 5GHz band.



3.3 Hardware Pinouts

GPIO Pin Assignment

GPIO PIN	Function	GPIO PIN	Function
GPIO_17	WLAN_LED	GPIO_19	WD_N
GPIO_20	I2C_SDA	GPIO_22	I2C_CLK
GPIO_18	WLAN_DISABLE_N		

MiniPCle Slot Pin Assignment

Top side		Bottom side	
1	WAKE_L	2	+3.3V
3	CHIP_PWD_L	4	GND
5	NC	6	NC
7	CLKREQ_L	8	NC
9	GND	10	NC
11	REFCLK-	12	NC
13	REFCLK+	14	NC
15	GND	16	NC
Mechanical key MiniPCle			
17	NC	18	GND
19	NC	20	WLAN_DISABLE_N
21	GND	22	PERST_L
23	PERn0	24	+3.3V
25	PERp0	26	GND
27	GND	28	NC
29	GND	30	NC
31	PETn0	32	NC
33	PETp0	34	GND
35	GND	36	NC
37	GND	38	NC
39	+3.3V	40	GND
41	+3.3V	42	NC
43	NC	44	LED_WLAN_L
45	NC	46	NC
47	NC	48	NC
49	NC	50	GND
51	NC	52	+3.3V

4. Radio Module Specifications

4.1 Wi-Fi Capability

Wi-Fi Standards	802.11a/n/ac
Bands	5GHz Single Band
MIMO Configuration	4×4 MU-MIMO
Max Physical Data Rate	up to 1733 Mbps
Frequency Range	5.150 ~ 5.825GHz
Modulation Techniques	OFDM: BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM
Channel Spectrum Widths	Supports 20/40/80/80+80MHz at 5GHz
TX Power	Max 21dBm per chain @ 5GHz
RF Connectors	4× U.FL Connectors (CH0, CH1, CH2, CH3)
Advanced RF Features	Spatial Multiplexing, Cyclic-Delay Diversity (CDD), Low-Density Parity Check (LDPC) Codes, Maximal Ratio Combining (MRC), Space Time Block Code (STBC)
Supported Standards	IEEE 802.11d, e, h, i, j, k, r, u, v, w and z

4.2 Notes & Recommendations

- Use external antennas rated for the 5GHz band on all four U.FL connectors to fully utilize the 4×4 MU-MIMO capability.
- Refer to the CompexWRT (v3.x and above, Qualcomm Atheros reference wireless drivers) or OpenWRT/LEDE (ath10k wireless drivers) documentation for channel and regulatory domain configuration. Supported on WPJ558, WPJ563, WPJ564 (up to 800Mbps) and WPQ864, WPQ865 (up to 1300Mbps).
- This module supports Dynamic Frequency Selection (DFS); ensure local regulatory requirements for DFS channels are met before deployment.
- The 80+80MHz channel mode supports 2 spatial streams (2SS); for maximum 4SS throughput, use 80MHz channel width.
- Actual throughput will vary depending on host platform, driver configuration, channel width, and RF environment.

5. Mechanical Specifications

5.1 Module Dimensions

Dimensions (W × H × D)	29.9mm × 50.8mm × 12.9mm
Form Factor	Standard MiniPCle with heatsink

5.2 Environmental Ratings

Operating Temperature	-40°C to 85°C
Storage Temperature	-40°C to 90°C
Operating Humidity	5% to 95%, Non-Condensing
Storage Humidity	Max. 90%

5.3 Mounting & Installation Notes

- Secure with the mounting screw at the designated hole if the host chassis provides one.
- The integrated heatsink allows free air (convection) operation without requiring forced cooling in standard deployment conditions.
- Ensure adequate airflow or thermal contact with the heatsink fins for sustained high-throughput operation.

6. Power Specifications

6.1 Power Requirements

Operating Voltage	3.3V DC
Power Consumption	8.5W (Max)
Power Source	Supplied via MiniPCle edge connector from host platform

6.2 Power Delivery Protection

- The host platform's MiniPCle slot is responsible for providing regulated 3.3V power and short-circuit/overcurrent protection.
- Ensure the host power rail can supply the module's peak 8.5W power consumption without voltage droop.

6.3 Notes & Recommendations

- Use a host platform with a stable, well-regulated 3.3V MiniPCle power rail.
- Avoid hot-plugging the module; always power down the host before installation or removal.
- For high-duty-cycle or industrial deployments, verify thermal dissipation is adequate at sustained 8.5W operation.

7. Installation & Integration

7.1 Pre-Installation Checklist

- Power off and disconnect the host platform before installation.
- Verify the host platform provides a MiniPCle slot compatible with PCIe 2.0.
- Prepare external antennas rated for 5GHz with U.FL connectors or pigtail adapters.

7.2 Module Installation

- Align the WLE1216V5-20-I module's gold-finger edge connector with the host MiniPCle slot.
- Insert at a slight angle (typically 15–20°) and press down firmly until fully seated.
- Rotate the module flat and secure with the mounting screw if provided by the host chassis.

7.3 Power Connection

- Power is supplied automatically through the MiniPCle edge connector; no separate power cable is required.
- Confirm the host platform's MiniPCle slot delivers a stable 3.3V supply before powering on.

7.4 Antenna Connection

- Connect external antennas to the CH0, CH1, CH2 and CH3 U.FL connectors.
- Ensure antenna cables are routed without sharp bends to avoid signal loss or connector damage.

8. Troubleshooting

Module Not Detected	•Verify the module is fully seated in the MiniPCle slot and the retaining screw (if present) is secured. •Confirm the host platform's MiniPCle slot supports PCIe 2.0 and provides 3.3V power. •Check that the appropriate Linux driver/SDK package is installed on the host.
No Wireless Signal / Weak RF Performance	•Verify external antennas are securely connected to the CH0, CH1, CH2 and CH3 U.FL connectors. •Confirm antennas are rated for the 5GHz in use. •Check for physical damage to U.FL connectors or antenna cables.
Overheating or Unexpected Shutdown	•Ensure adequate airflow or thermal contact with the heatsink fins for sustained high-throughput operation. •Confirm ambient temperature is within the rated -40°C to 85°C operating range. •For sustained high-throughput or industrial use, consider a customized heatsink solution.

9. Safety Precautions

- Always power off and disconnect the host system before installing or removing the module.
- Handle the module by its edges; avoid touching the gold-finger connector or RF components.
- Use proper ESD (electrostatic discharge) precautions, including a grounded wrist strap, when handling the module.
- Do not operate the module without an antenna connected, as this may damage the transmitter.
- Operation in DFS channels is subject to local regulatory requirements — see Section 12 for details.
- Do not attempt to modify or repair the module; contact Complex Technical Support for service.

10. Technical Support

Compex Systems Pte Ltd provides engineering and technical support for the WLE1216V5-20-I. For technical assistance, integration support, or to report a hardware issue, please contact:

Company	Compex Systems Pte Ltd
Headquarters	Singapore
Sales Enquiries	sales@compex.com.sg
Technical Support	https://compex.com.sg/support-downloads/
Website	https://compex.com.sg
Product Page (WLE1216V5-20-I)	https://compex.com.sg/shop/wifi-module/802-11ac-wave-2/wle1216v5-20-i-temp-2/
Qualcomm Design Centre	Qualcomm Authorized Design Centre (ADC) since 2014

Before contacting support, please:

- Note the firmware version (visible via webUI: System > Software, or via SSH/serial console: `cat /etc/openwrt_release`)
- Record the MAC address of the board (visible on PCB label).
- Describe the issue with steps to reproduce, observed symptoms, and host platform details.

For sample requests, pre-production evaluations, or OEM/ODM partnership enquiries, contact the Compex sales team at sales@compex.com.sg.

11. Full Specifications

Model	WLE1216V5-20-I
Chipset	Qualcomm Atheros QCA9994 'Cascade' Series
System Memory	256Kbit serial I ² C bus EEPROM
Reference Design	Qualcomm Atheros CUS239
Host Interface	MiniPCle Interface with PCIe 2.0
Operating Voltage	3.3V
Power Consumption	8.5W (Max)
Wireless	4×4 5GHz 802.11a/n/ac, max 21dBm per chain 4× U.FL Connectors
Frequency Range	5.150 ~ 5.825GHz
Modulation Techniques	OFDM: BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM
Channel Spectrum Widths	Supports 20/40/80/80+80MHz at 5GHz
Operating System	CompexWRT (v3.x+, Qualcomm Atheros drivers) or OpenWRT/LEDE (ath10k); WPJ558/563/564: up to 800Mbps, WPQ864/865: up to 1300Mbps
Certification	FCC, IC & CE RED Certified, REACH & RoHS Compliance
Environmental Temperature	Operating: -40°C to 85°C Storage: -40°C to 90°C
Environmental Humidity	Operating: 5% to 95%, Non-Condensing Storage: Max. 90%
Dimensions (W × H × D)	29.9mm × 50.8mm × 12.9mm

12. Regulatory Information

Declaration of Conformity

The WLE1216V5-20-I is FCC, IC and CE RED Certified and designed to comply with applicable regional regulatory requirements. The WLE1216V5-20-I is a component-level radio module intended for integration into end products. End-product manufacturers are responsible for obtaining all necessary regulatory certifications (e.g., FCC, CE, IC, or other applicable regional approvals) for their final product in each target market, including any additional certifications required for the complete host platform assembly.

REACH & RoHS Compliance

This product is manufactured in compliance with REACH Regulation (EC) No 1907/2006 and RoHS Directive 2011/65/EU (amended by 2015/863/EU), restricting the use of hazardous substances in electrical and electronic equipment.

Disposal & Recycling

This product is subject to the Waste Electrical and Electronic Equipment (WEEE) Directive. At the end of its service life, return the product to an authorised recycling facility or contact Compex Systems for take-back options.

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