Product Specifications

HH9880-BA V1.0

IEEE 802.11bgn/ac

Dual Band 5GHz 3x3 MIMO 802.11ac Mini PCIE WiFi Module

Version: V1.0

Table of Contents

1. Revision History

Date	Version	Author	Description
2022/10/24	1.0	Peter	1st release

2. Photo

3. Key Features

- Qualcomm Atheros QCA9880
- 2.4GHz max 21dBm & 5GHz max 20dBm output power (per chain)
- IEEE 802.11ac compliant & backward compatible with 802.11a/b/g/n/ac
- 3x3 MIMO Technology, up to 1300Mbps
- Mini PCI Express edge connector
- Supports Spatial Multiplexing, Cyclic-Delay Diversity (CDD), Low-Density Parity Check (LDPC) Codes, Maximal Ratio Combining (MRC), Space Time Block Code (STBC)
- Supports IEEE 802.11d, e, h, i, k, r, v time stamp, and w standards
- Supports Dynamic Frequency Selection (DFS)
- Cards are individually calibrated for Quality Assurance

4. Product Specification

4.1 Hardware Specification

The Hardware specifications of the product are as below:

Features	Additional Information			
Chipset Solution	CPU / RF Transceiver : QCA9880			
Wi-Fi Standard	IEEE 802.11ac compliant & backward compatible with 802.11a/b/g/n			
Operation Voltage	3.3V			
Operation Frequency & Channel	- IEEE 802.11b/g/gn 20MHz ISM Band • USA (FCC): 2.412GHz~2.462GHz • Europe (ETSI) : 2.412GHz~2.472GHz - IEEE 802.11gn 40MHz Band • USA (FCC): 2.422GHz~2.452GHz • Europe (ETSI) : 2.422GHz~2.462GHz - IEEE 802.11a/an 20MHz/40MHz ISM Band • USA (FCC): 5.15GHz~5.25GHz; 5.725GHz~5.85GHz • Europe (ETSI): 5.15GHz~5.35GHz; 5.47GHz~5.725GHz			
Available Interfaces	MiniPCIe interface with PCIe 1.1 3 x U.FL Connectors			
Power Consumption	5W (Max)			
Modulation	- IEEE 802.11 a/b/g • DSSS (DBPSK, DQPSK, CCK) • OFDM (BPSK, QPSK, 16-QAM, 64-QAM) - IEEE 802.11gn • OFDM (BPSK, QPSK, 16-QAM, 64-QAM) - IEEE 802.11ac • OFDM (BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM)			
Data Rate	- 802.11a/g: 6/9/12/18/24/36/48/54 Mbps & Auto fallback - 802.11b: 1/2/5.5/11 Mbps & Auto fallback - 802.11n: up to 450Mbps - 802.11ac: up to 1300Mbps			
Output Power (Single chain) Tolerance ±2dB **All modes are measured via single chain	11b	1Mbps		20 dBm
		11Mbps		20 dBm
	11g	6Mbps		21 dBm
		54Mbps		18 dBm
	11a	6Mbps		21 dBm
		54Mbps		15 dBm
	11gn	HT20	MCS0	21 dBm
			MCS7	14 dBm

		HT40	MCS0	20 dBm
			MCS7	14 dBm
	11an	HT20	MCS0	19 dBm
			MCS7	14 dBm
		HT40	MCS0	18 dBm
			MCS7	14 dBm
	11ac	VHT20	MCS0	19 dBm
			MCS8	13 dBm
		VHT40	MCS0	18 dBm
			MCS9	13 dBm
		VHT80	MCS0	18 dBm
			MCS9	13 dBm
Sensitivity (Single chain)	11g	54Mpcs		-76dBm
	11a	54Mbps		-76dBm
	11gn	HT20	MCS7	-73dBm
		HT40	MCS7	-71dBm
	11an	HT20	MCS7	-74dBm
		HT40	MCS7	-71dBm
	11ac	VHT20	MCS8	-69dBm
		VHT40	MCS9	-65dBm
		VHT80	MCS9	-61dBm

4.2 Physical specification

The Physical specifications of the product are as below:

Items	Description
Outline Dimension	29.85 × 50.8 × 3.2 (mm)
Weight	≦ 50g

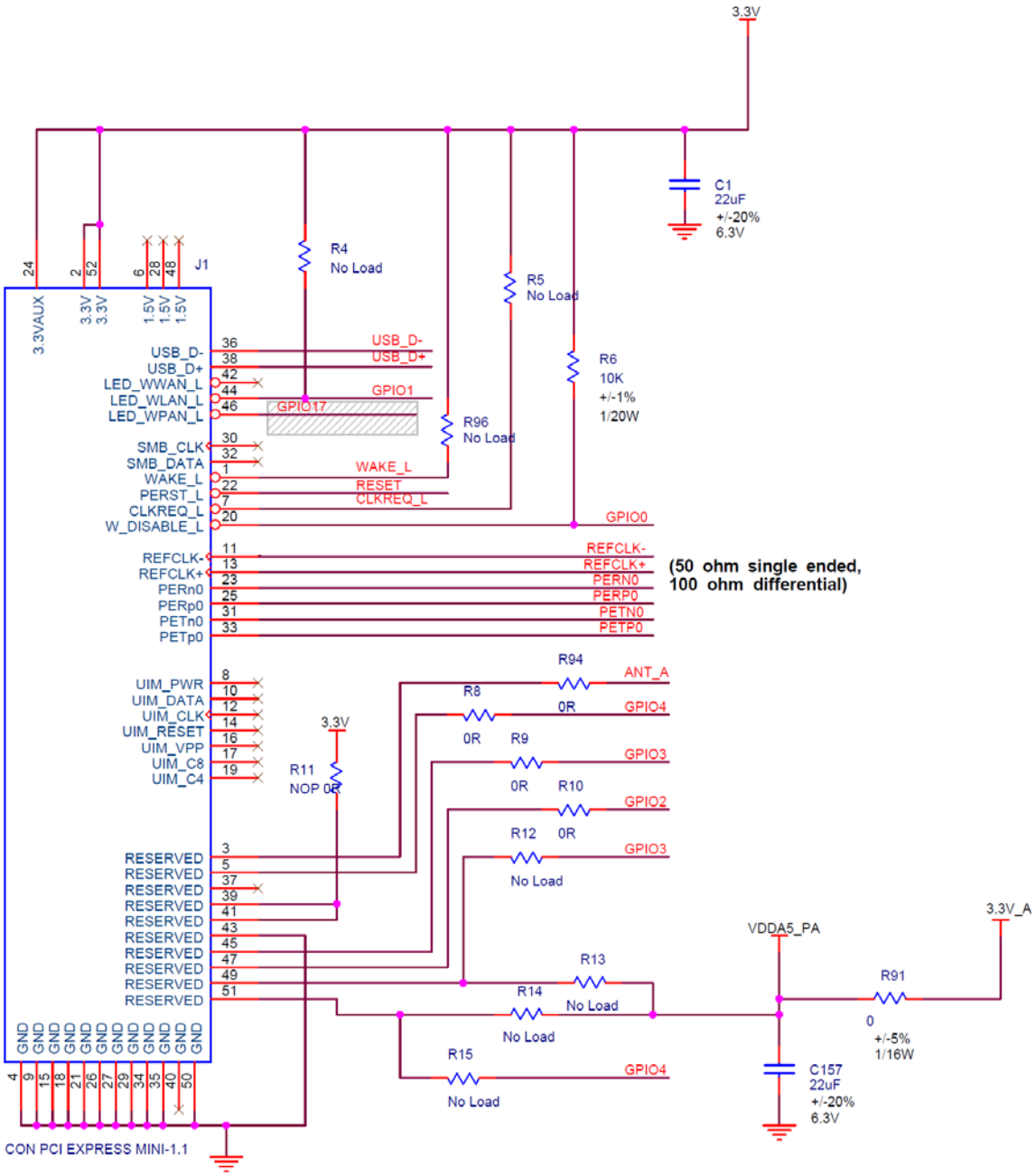
4.3 Environment Specification

The environment specifications of the product are as below:

Items	Description

Operating Temperature	-20°C to 70°C
Storage Temperature	-40°C to 90°C
Operating Humidity	5% ~ 95% RH
Storage Humidity	Max. 90%
Green	RoHS compliant
Warranty	1 year

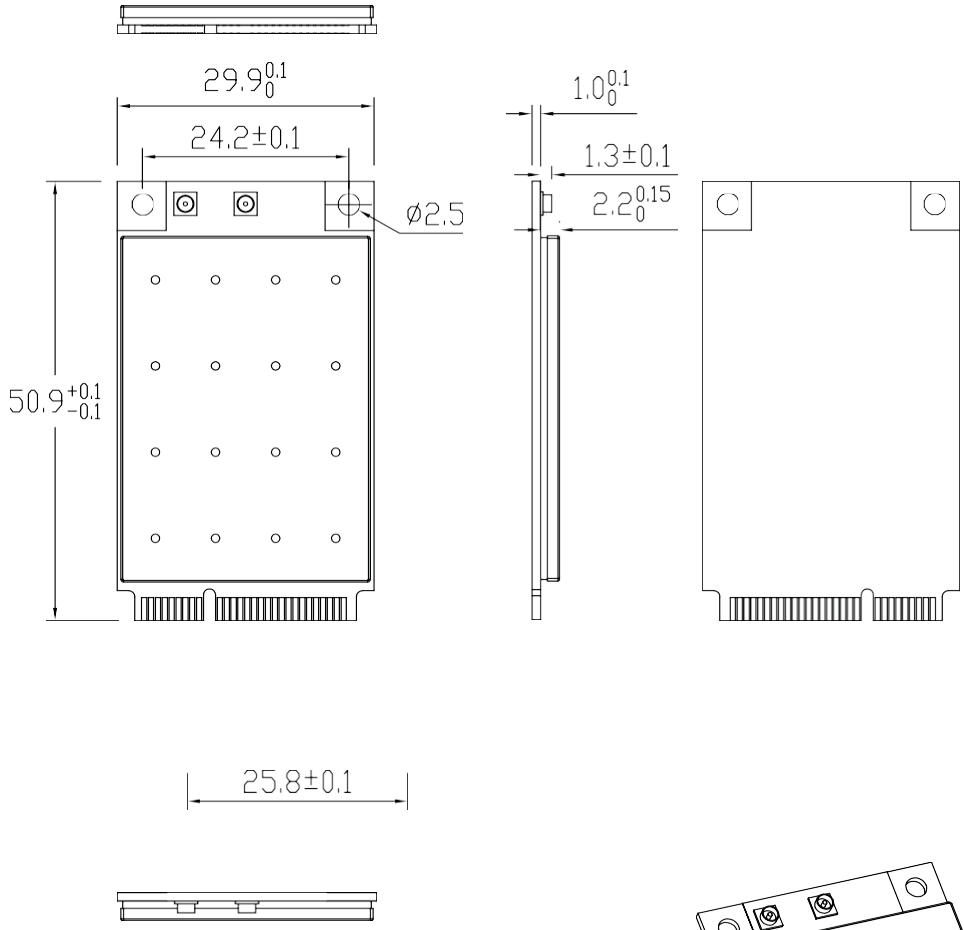
4.4 Pin Assignment

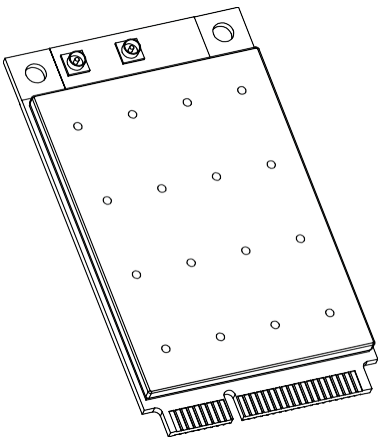


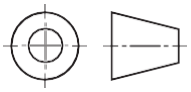
Pin Number	Name	I/O	Descriptions
1	WAKE_L	OD	PCIE_WAKE_L, Active Low
2	3.3V	PI	
3	GPIO19	I/O	ANT_A
4	GND		
5	GPIO4	I/O	MCI_DATA_OUT/SM_ANT2
6	NC		
7	CLKREQ_L	OD	PCIE_CLKREQ_L, Active Low
8	NC		
9	GND		
10	NC		
11	REFCLK-	IA	Differential reference clock(100 MHz)
12	NC		
13	REFCLK+	IA	Differential reference clock(100 MHz)
14	NC		
15	GND		
16	NC		
17	NC		
18	GND		
19	NC		
20	GPIO0	I/O	W_DISABLE_L, Internal Pull-High, Active Low
21	GND		
22	RESET	IL	PCIE_RST_L, Active Low
23	PERN0	OA	PCIE transmit data (-)
24	3.3V	PI	
25	PERP0	OA	PCIE transmit data (+)
26	GND		
27	GND		
28	NC		
29	GND		

30	NC		
31	PETN0	IA	PCIE receive data (+)
32	NC		
33	PETP0	IA	PCIE receive data (-)
34	GND		
35	GND		
36	USB_D+		NC
37	NC		
38	USB_D-		NC
39	NC		
40	NC		
41	NC		
42	NC		
43	GND		
44	GPIO1	I/O	W_LED
45	GPIO3	I/O	MCI_CLK_OUT/SM_ANT1
46	GPIO17	I/O	BT_LED
47	GPIO2	I/O	MCI_CLK_IN/SM_ANT0
48	NC		
49	NC		
50	GND		
51	NC		
52	3.3V	PI	

5. Mechanical Dimensions







All dimensions are in mm.

6. RF Performance Table

	Data Rate	TX Power (per chain)	TX Power (2 chains)	Tolerance
2.4GHz 802.11b	1Mbps	20dBm	23dBm	±2dB
	2Mbps	20dBm	23dBm	±2dB
	5.5Mbps	20dBm	23dBm	±2dB
	11Mbps	20dBm	23dBm	±2dB
2.4GHz 802.11g	6Mbps	21dBm	24dBm	±2dB
	9Mbps	21dBm	24dBm	±2dB
	12Mbps	21dBm	24dBm	±2dB
	18Mbps	21dBm	24dBm	±2dB
	24Mbps	21dBm	24dBm	±2dB
	36Mbps	20dBm	23dBm	±2dB
	48Mbps	19dBm	22dBm	±2dB
	54Mbps	18dBm	21dBm	±2dB
2.4GHz 802.11n HT20	MCS 0	21dBm	24dBm	±2dB
	MCS 1	21dBm	24dBm	±2dB
	MCS 2	21dBm	24dBm	±2dB
	MCS 3	20dBm	23dBm	±2dB
	MCS 4	20dBm	23dBm	±2dB
	MCS 5	20dBm	23dBm	±2dB
	MCS 6	18dBm	21dBm	±2dB
	MCS 7	16dBm	19dBm	±2dB
2.4GHz 802.11n HT40	MCS 0	20dBm	23dBm	±2dB
	MCS 1	20dBm	23dBm	±2dB
	MCS 2	20dBm	23dBm	±2dB
	MCS 3	19dBm	22dBm	±2dB
	MCS 4	19dBm	22dBm	±2dB
	MCS 5	19dBm	22dBm	±2dB
	MCS 6	18dBm	21dBm	±2dB
	MCS 7	16dBm	19dBm	±2dB

	Data Rate	RX Specifications Sensitivity	Tolerance
2.4GHz 802.11b	1Mbps	-95dBm	±2dB
	2Mbps	-94dBm	±2dB
	5.5Mbps	-92dBm	±2dB
	11Mbps	-90dBm	±2dB
2.4GHz 802.11g	6Mbps	-94dBm	±2dB
	9Mbps	-93dBm	±2dB
	12Mbps	-92dBm	±2dB
	18Mbps	-90dBm	±2dB
	24Mbps	-88dBm	±2dB
	36Mbps	-85dBm	±2dB
	48Mbps	-81dBm	±2dB
	54Mbps	-80dBm	±2dB
2.4GHz 802.11n HT20	MCS 0	-93dBm	±2dB
	MCS 1	-91dBm	±2dB
	MCS 2	-89dBm	±2dB
	MCS 3	-84dBm	±2dB
	MCS 4	-83dBm	±2dB
	MCS 5	-78dBm	±2dB
	MCS 6	-78dBm	±2dB
	MCS 7	-76dBm	±2dB
2.4GHz 802.11n HT40	MCS 0	-92dBm	±2dB
	MCS 1	-88dBm	±2dB
	MCS 2	-85dBm	±2dB
	MCS 3	-82dBm	±2dB
	MCS 4	-79dBm	±2dB
	MCS 5	-75dBm	±2dB
	MCS 6	-75dBm	±2dB
	MCS 7	-73dBm	±2dB

	Data Rate	TX Power (per chain)	TX Power (2 chains)	Tolerance
5GHz 802.11a	6Mbps	20dBm	23dBm	±2dB
	9Mbps	20dBm	23dBm	±2dB
	12Mbps	20dBm	23dBm	±2dB
	18Mbps	20dBm	23dBm	±2dB
	24Mbps	20dBm	23dBm	±2dB
	36Mbps	18dBm	21dBm	±2dB
	48Mbps	16dBm	19dBm	±2dB
	54Mbps	15dBm	18dBm	±2dB
5GHz 802.11n/ac VHT20	MCS 0	19dBm	22dBm	±2dB
	MCS 1	19dBm	22dBm	±2dB
	MCS 2	19dBm	22dBm	±2dB
	MCS 3	18dBm	21dBm	±2dB
	MCS 4	18dBm	21dBm	±2dB
	MCS 5	17dBm	20dBm	±2dB
	MCS 6	16dBm	19dBm	±2dB
	MCS 7	14dBm	17dBm	±2dB
	MCS 8	13dBm	16dBm	±2dB
5GHz 802.11n/ac VHT40	MCS 0	18dBm	21dBm	±2dB
	MCS 1	18dBm	21dBm	±2dB
	MCS 2	18dBm	21dBm	±2dB
	MCS 3	17dBm	20dBm	±2dB
	MCS 4	17dBm	20dBm	±2dB
	MCS 5	16dBm	19dBm	±2dB
	MCS 6	15dBm	18dBm	±2dB
	MCS 7	14dBm	17dBm	±2dB
	MCS 8	13dBm	16dBm	±2dB
	MCS 9	13dBm	16dBm	±2dB
5GHz 802.11ac VHT80	MCS 0	18dBm	21dBm	±2dB
	MCS 1	18dBm	21dBm	±2dB
	MCS 2	18dBm	21dBm	±2dB
	MCS 3	17dBm	20dBm	±2dB
	MCS 4	17dBm	20dBm	±2dB
	MCS 5	16dBm	19dBm	±2dB
	MCS 6	15dBm	18dBm	±2dB
	MCS 7	14dBm	17dBm	±2dB
	MCS 8	13dBm	16dBm	±2dB
	MCS 9	13dBm	16dBm	±2dB

	Data Rate	RX Specifications Sensitivity	Tolerance
5GHz 802.11a	6Mbps	-94dBm	±2dB
	9Mbps	-94dBm	±2dB
	12Mbps	-92dBm	±2dB
	18Mbps	-90dBm	±2dB
	24Mbps	-86dBm	±2dB
	36Mbps	-84dBm	±2dB
	48Mbps	-81dBm	±2dB
	54Mbps	-80dBm	±2dB
5GHz 802.11n/ac VHT20	MCS 0	-93dBm	±2dB
	MCS 1	-90dBm	±2dB
	MCS 2	-87dBm	±2dB
	MCS 3	-83dBm	±2dB
	MCS 4	-80dBm	±2dB
	MCS 5	-77dBm	±2dB
	MCS 6	-74dBm	±2dB
	MCS 7	-73dBm	±2dB
	MCS 8	-71dBm	±2dB
5GHz 802.11n/ac VHT40	MCS 0	-90dBm	±2dB
	MCS 1	-88dBm	±2dB
	MCS 2	-85dBm	±2dB
	MCS 3	-82dBm	±2dB
	MCS 4	-79dBm	±2dB
	MCS 5	-75dBm	±2dB
	MCS 6	-73dBm	±2dB
	MCS 7	-73dBm	±2dB
	MCS 8	-69dBm	±2dB
	MCS 9	-66dBm	±2dB
5GHz 802.11ac VHT80	MCS 0	-88dBm	±2dB
	MCS 1	-86dBm	±2dB
	MCS 2	-84dBm	±2dB
	MCS 3	-81dBm	±2dB
	MCS 4	-77dBm	±2dB
	MCS 5	-74dBm	±2dB
	MCS 6	-73dBm	±2dB
	MCS 7	-70dBm	±2dB
	MCS 8	-67dBm	±2dB
	MCS 9	-65dBm	±2dB

* List of applicable FCC rules
2.2FCC Part15 Subpart C, Section 15.247
2.3Specific operational use conditions
Sufficient Power Supply.
Wi-Fi Module is a mini-PCIe module and would be attached to the mini-PCIe interface of the main device.
As the transmitter power would require adequate power supply to the module for good performance, it is important to have at least 3.3V and 1A supplying to the module.
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Documents are provided by the current version without any guaranteed responsibility, including merchantability, suitable for any particular purpose or non-infringement guarantees, and any guarantees presented by any proposal, specification, or sample mentioned elsewhere. This document has no responsibility, including the use of the information within this document produced by the infringement of any patent rights. This document in this, by estoppel or otherwise, grant any intellectual property licensing,
whether express or implied license.

2.4 Limited module procedures
Not applicable. The module is a Single module and complies with the requirement of FCC Part 15. 212.
2.5 Trace antenna designs
Not applicable. The module has its own antenna, and doesn’ t need a host’ s printed board microst rip trace antenna etc.
2.6 RF exposure considerations
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.
2.7 Antennas
Antenna Specification are as follows:
Type: Rod antenna
Gain: Wi-Fi 2.4G ANT1/ANT2/ANT3: 2.32dBi
Wi-Fi 5.2G ANT1/ANT2/ANT3: 1.59dBi
Wi-Fi 5.8G ANT1/ANT2/ANT3: 4.51dBi

This device is intended only for host manufacturers under the following conditions:
The transmitter module may not be co-located with any other transmitter or antenna;

The module shall be only used with the External antenna(s) that has been originally tested and certified
with this module. The antenna must be either permanently attached or employ a ‘ unique’ antenna coupler.
2.8 Label and compliance information
Host product manufacturers need to provide a physical or e-label stating “ Contains FCC ID: 2A9SPHH9880-BA
with their finished product.
2.9 Information on test modes and additional testing requirements Operation Frequency:
WIFI 2.4G:
2412~2462MHz for 802.11b/g/n(HT20)
2422~2452MHz for 802.11n(HT40) WIFI 5.2G: 5180~5240MHz WIFI 5.8G: 5745~5825MHz
Number of Channel:
WIFI 2.4G:
11 Channels for 802.11b/g/n(HT20)
7 Channels for 802.11n(HT40)
WIFI 5.2G:
4 Channels for 802.11a/n(HT20)/ac(HT20)
2 Channels for 802.11n(HT40)/ac(HT40)
1 Channels for 802.11ac(HT80)
WIFI 5.8G:
5 Channels for 802.11a/n(HT20)/ac(HT20)
2 Channels for 802.11n(HT40)/ac(HT40)
1 Channels for 802.11ac(HT80)
Modulation:
WIFI 2.4G: CCK, DQPSK, DBPSK for DSSS; 64QAM, 16QAM, QPSK, BPSK for OFDM
WIFI 5G: OFDM with BPSK/QPSK/16QAM/64QAM/256QAM
Host manufacturer must perfom test of radiated & conducted emission and spurious emission, etc according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.
Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.
2.10All the mentioned brand names, trademarks and registered trademarks presented in this document are the property of their respective owners, and hereby declare.
FCC regulatory information

This device complies with Part 15 of the FCC Rules. Operation is subjected 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.

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 different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

Warning: Changes or modifications not expressly approved by the party responsible for compliance could void the user’ s authority to operate the equipment.