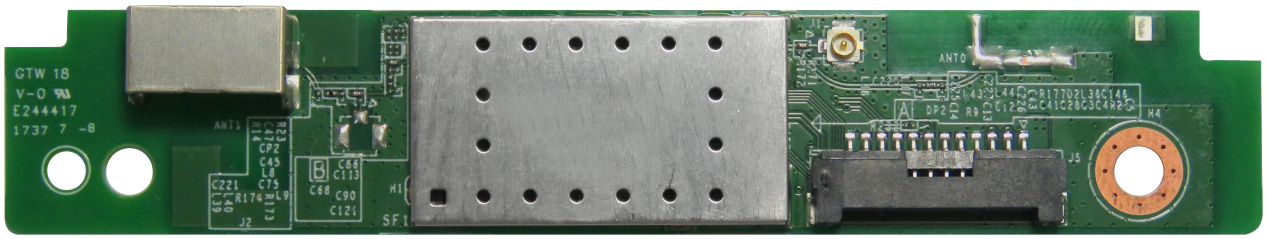
DHUA-W8 Information Sheet

802.11 ac/a/b/g/n 2x2 wifi and Bluetooth 4.1 LE combo USB module, QCA9378



Overview:

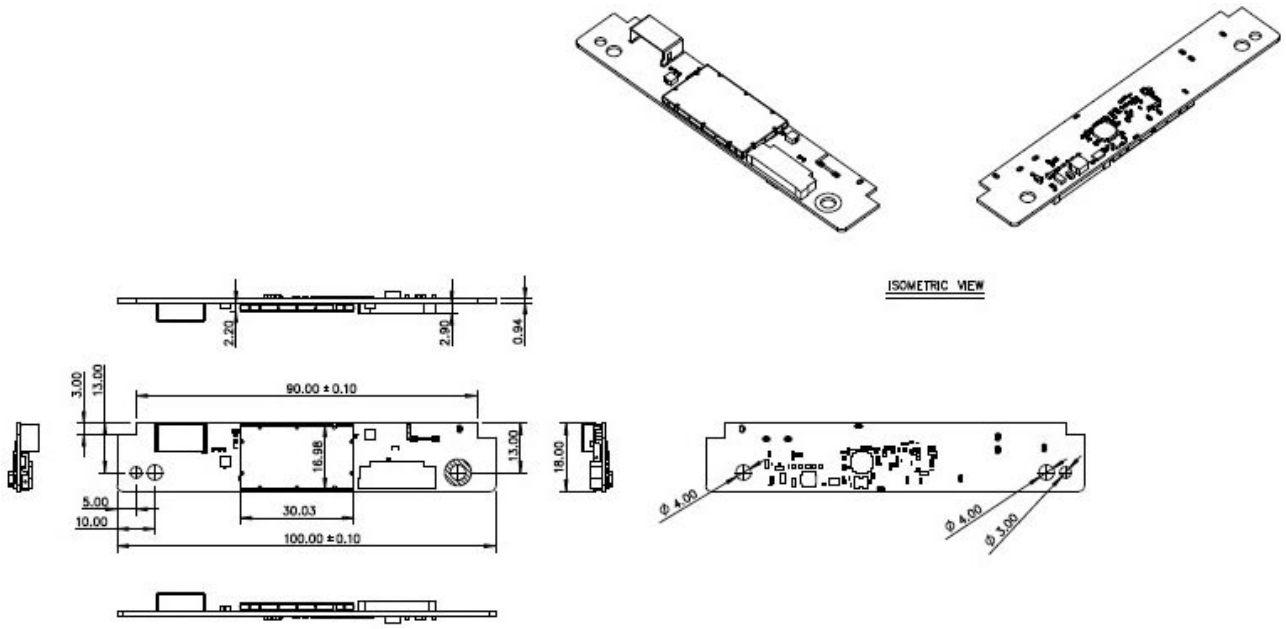
DHUA-W8 is an 802.11 ac/a/b/g/n dual band 2x2 wifi and Bluetooth combo USB module designed for devices which require high throughput and lower-power consumption. It's a highly integrated module that supports 2-stream 802.11ac/a/b/g/n MIMO technology with data rate from MCS 0-15 in 20MHz/40MHz/80MHz channels, and Bluetooth 4.1 LE.

Advanced integrated coexistence features deliver superior WiFi/Bluetooth coexistence to ensure the best possible wireless experience, maximum performance, and lowest power consumption.

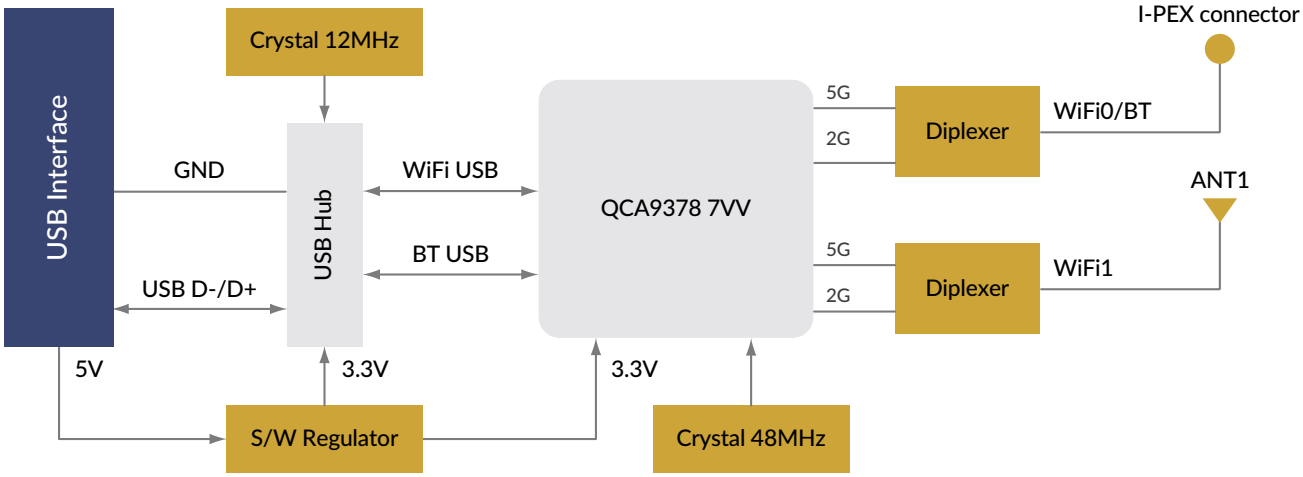
Features:

- High integrated dual-band (2.4/5GHz) 802.11 ac/a/b/g/n 2Tx/2Rx WiFi and Bluetooth combo solution in USB module is ideal for devices requiring high throughput and low-power connectivity.
- Dual-stream spatial multiplexing up to 867 Mbps data rate, supports 20, 40, and 80 MHz bandwidth with optional SGI (256 QAM modulation).
- Complies with Bluetooth Core Specification Version 4.1 + EDR with provisions for supporting future specifications.
- Bluetooth supports Class I or Class II transmitter operation.
- Supports Wake on WLAN and Bluetooth function.
- Advanced coexistence mechanism between Wi-Fi and Bluetooth ensure the best possible wireless experience, maximum performance, and lowest power consumption.
- One on-board metallic antenna and one I-PEX connector for external antenna enable highest design flexibility.
- Individual power calibration ensures high performance and stable quality.
- RoHS and REACH compliances meet environment-friendly requirement.

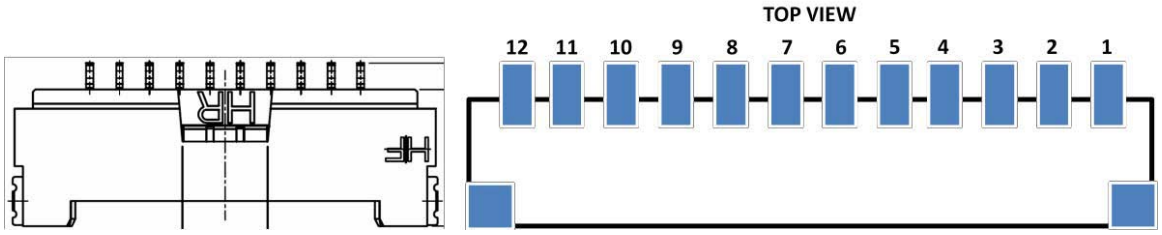
Outline:



Block Diagram:



Pin Assignment:



Pin Number	Pin Name	Pin Type	Description
1	5V	Power	5V Power Supply
2	USB_D-	I/O	USB_N
3	USB_D+	I/O	USB_P
4	GND	GND	GND
5	BT_REG_ON	I	Reset BT
6	BT_HOST_WAKE	O	BT wake up host
7	BT_DEV_WAKE	I	Host wake up BT
8	5V	Power	5V Power Supply
9	WL_REG_ON	I	Reset WiFi
10	WL_HOST_WAKE	O	WiFi wake up host
11	NC	-	NC
12	GND	GND	GND

Specifications:

1. WiFi portion:

Main Chipset	QCA QCA9378 7VV
Frequency Range	2.400 ~ 2.497GHz,5.15GHz ~ 5.85GHz
Modulation Technique	» 802.11 a/b/g DSSS (DBPSK, DQPSK, CCK) OFDM (BPSK, QPSK, 16-QAM, 64-QAM) DSSS (Direct Sequence Spread Spectrum) with DBPSK (Differential Binary Phase Shift Keying 1Mbps), DQPSK (Differential Quaternary Phase Shift Keying 2Mbps), and CCK (ComplementaryCode Keying 5.5&11Mbps), and OFDM (Orthogonal Frequency Division Multiplexing with BPSK for 6,9Mbps, QPSK for 12,18Mbps, 16QAM for 24,36Mbps, 64QAM for 48,54Mbps) » 802.11n a/g OFDM (BPSK, QPSK, 16-QAM, 64-QAM) » 802.11 ac OFDM (BPSK, QPSK, 16-QAM, 64-QAM,256-QAM)
Host Interface	USB 2.0
Operation Voltage	5V DC ±9% (including voltage ripple)
Standby mode power consumption	< 0.1W (Test condition is the module on TV platform for standby mode)

Power Consumption @25°C

Mode	Average		Peak	
	2.4G	5G	2.4G	5G
Wi-Fi Tx	560mA	710mA	630mA	830mA
Wi-Fi Rx	100mA	100mA	180mA	180mA
Driver disable	70mA		140mA	
Standby Wi- Fi+BT	65mA		130mA	

*Wi-Fi Tx and Rx is for continuous Tx and Rx

**Power consumption measured on PC platform.

Output Power (for each chain; tolerance +1.5/-1.5 dB)

» 802.11a:

Test Frequencies	6-12_ Target	18_ Target	24_ Target	36_ Target	48_ Target	54_ Target
5180	14	14	14	13	12	12
5320	14	14	14	13	12	12
5500	14	14	14	13	12	12
5600	14	14	14	13	12	12
5700	14	14	14	13	12	12
5825	14	14	14	13	12	12

» 802.11b:

Test Frequencies	1/2_ Target	5.5_ Target	11_ Target
2412	15	15	15
2442	15	15	15
2472	15	15	15

» 802.11g:

Test Frequencies	6-12_ Target	18_ Target	24_ Target	36_ Target	48_ Target	54_ Target
2412	14	14	14	14	14	14
2442	14	14	14	14	14	14
2472	14	14	14	14	14	14

» 802.11n / Freq. Range: HT20:

Test	MCS	MCS	MCS	MCS	MCS	MCS	MCS	MCS
Freq	0/8	1/9	2/10	3/11	4/12	5/13	6/14	7/15
5180	11	11	11	11	11	11	11	11
5240	11	11	11	11	11	11	11	11
5320	11	11	11	11	11	11	11	11
5500	11	11	11	11	11	11	11	11
5700	11	11	11	11	11	11	11	11
5745	11	11	11	11	11	11	11	11
5825	11	11	11	11	11	11	11	11

» 802.11n / Freq. Range: HT40:

Test	MCS	MCS	MCS	MCS	MCS	MCS	MCS	MCS
Freq	0/8	1/9	2/10	3/11	4/12	5/13	6/14	7/15
5190	11	11	11	11	11	11	11	11
5230	11	11	11	11	11	11	11	11
5270	11	11	11	11	11	11	11	11
5510	11	11	11	11	11	11	11	11
5670	11	11	11	11	11	11	11	11
5755	11	11	11	11	11	11	11	11
5795	11	11	11	11	11	11	11	11

» 802.11n / Freq. Range: HT20:

Test	MCS	MCS	MCS	MCS	MCS	MCS	MCS	MCS
Freq	0/8	1/9	2/10	3/11	4/12	5/13	6/14	7/15
2412	14	14	14	14	14	14	14	14
2447	14	14	14	14	14	14	14	14
2472	14	14	14	14	14	14	14	14

» 802.11n / Freq. Range: HT40:

Test	MCS	MCS	MCS	MCS	MCS	MCS	MCS	MCS
Freq	0/8	1/9	2/10	3/11	4/12	5/13	6/14	7/15
2422	14	14	14	14	14	14	14	14
2447	14	14	14	14	14	14	14	14
2462	14	14	14	14	14	14	14	14

» 802.11ac / Freq. Range: HT80:

Test	MCS	MCS	MCS	MCS	MCS	MCS	MCS	MCS	MCS	MCS
Freq	0	1	2	3	4	5	6	7	8	9
5210	8	8	8	8	8	8	8	8	7	7
5290	8	8	8	8	8	8	8	8	7	7
5530	8	8	8	8	8	8	8	8	7	7
5610	8	8	8	8	8	8	8	8	7	7
5690	8	8	8	8	8	8	8	8	7	7
5775	8	8	8	8	8	8	8	8	7	7

EVM

The transmit modulation accuracy is measured using error vector magnitude (EVM).

EVM is the magnitude of the phase difference as a function of time between an ideal reference signal and the measured transmitted signal.

» 802.11a:

Modulation	Code Rate	Relative constellation error (dB) IEEE Spec. (1Tx dB)	Relative constellation error (dB) Typical (1Tx dB)
BPSK	1/2	-5	-15
BPSK	3/4	-8	-18
QPSK	1/2	-10	-20
QPSK	3/4	-13	-22
16-QAM	1/2	-16	-24
16-QAM	3/4	-19	-26
64-QAM	2/3	-22	-28
64-QAM	3/4	-25	-30

» 802.11b:

Modulation	Code Rate	Relative constellation error (dB) IEEE Spec. (1Tx dB)	Relative constellation error (dB) Typical (1Tx dB)
DBPSK		-10	-12
DQPSK		-10	-12
CCK		-10	-12

» 802.11g:

Modulation	Code Rate	Relative constellation error (dB) IEEE Spec. (1Tx dB)	Relative constellation error (dB) Typical (1Tx dB)
BPSK	1/2	-5	-15
BPSK	3/4	-8	-18
QPSK	1/2	-10	-20
QPSK	3/4	-13	-22
16-QAM	1/2	-16	-24
16-QAM	3/4	-19	-26
64-QAM	2/3	-22	-28
64-QAM	3/4	-25	-30

» 802.11ng(HT20):

Modulation	Code Rate	Relative constellation error (dB) IEEE Spec. (1Tx dB)	Relative constellation error (dB) Typical (1Tx dB)
(MCS0) BPSK	1/2	-5	-15
(MCS1) QPSK	1/2	-10	-18
(MCS2) QPSK	3/4	-13	-20
(MCS3) 16-QAM	1/2	-16	-22
(MCS4) 16-QAM	3/4	-19	-24
(MCS5) 64-QAM	2/3	-22	-26
(MCS6) 64-QAM	3/4	-25	-28
(MCS7) 64-QAM	5/6	-27	-30
(MCS8) BPSK	1/2	-5	-15
(MCS9) QPSK	1/2	-10	-18
(MCS10) QPSK	3/4	-13	-20
(MCS11) 16-QAM	1/2	-16	-22
(MCS12) 16-QAM	3/4	-19	-24
(MCS13) 64-QAM	2/3	-22	-26
(MCS14) 64-QAM	3/4	-25	-28
(MCS15) 64-QAM	5/6	-27	-30

» 802.11ng(HT40):

Modulation	Code Rate	Relative constellation error (dB) IEEE Spec. (1Tx dB)	Relative constellation error (dB) Typical (1Tx dB)
(MCS0) BPSK	1/2	-5	-15
(MCS1) QPSK	1/2	-10	-18
(MCS2) QPSK	3/4	-13	-20
(MCS3) 16-QAM	1/2	-16	-22
(MCS4) 16-QAM	3/4	-19	-24
(MCS5) 64-QAM	2/3	-22	-26
(MCS6) 64-QAM	3/4	-25	-28
(MCS7) 64-QAM	5/6	-27	-30
(MCS8) BPSK	1/2	-5	-15
(MCS9) QPSK	1/2	-10	-18
(MCS10) QPSK	3/4	-13	-20
(MCS11) 16-QAM	1/2	-16	-22
(MCS12) 16-QAM	3/4	-19	-24
(MCS13) 64-QAM	2/3	-22	-26
(MCS14) 64-QAM	3/4	-25	-28
(MCS15) 64-QAM	5/6	-27	-30

» 802.11na(HT20):

Modulation	Code Rate	Relative constellation error (dB) IEEE Spec. (1Tx dB)	Relative constellation error (dB) Typical (1Tx dB)
(MCS0) BPSK	1/2	-5	-15
(MCS1) QPSK	1/2	-10	-18
(MCS2) QPSK	3/4	-13	-20
(MCS3) 16-QAM	1/2	-16	-22
(MCS4) 16-QAM	3/4	-19	-24
(MCS5) 64-QAM	2/3	-22	-26
(MCS6) 64-QAM	3/4	-25	-28
(MCS7) 64-QAM	5/6	-27	-30
(MCS8) BPSK	1/2	-5	-15
(MCS9) QPSK	1/2	-10	-18
(MCS10) QPSK	3/4	-13	-20
(MCS11) 16-QAM	1/2	-16	-22
(MCS12) 16-QAM	3/4	-19	-24
(MCS13) 64-QAM	2/3	-22	-26
(MCS14) 64-QAM	3/4	-25	-28
(MCS15) 64-QAM	5/6	-27	-30

» 802.11na(HT40):

Modulation	Code Rate	Relative constellation error (dB) IEEE Spec. (1Tx dB)	Relative constellation error (dB) Typical (1Tx dB)
(MCS0) BPSK	1/2	-5	-15
(MCS1) QPSK	1/2	-10	-18
(MCS2) QPSK	3/4	-13	-20
(MCS3) 16-QAM	1/2	-16	-22
(MCS4) 16-QAM	3/4	-19	-24
(MCS5) 64-QAM	2/3	-22	-26
(MCS6) 64-QAM	3/4	-25	-28
(MCS7) 64-QAM	5/6	-27	-30
(MCS8) BPSK	1/2	-5	-15
(MCS9) QPSK	1/2	-10	-18
(MCS10) QPSK	3/4	-13	-20
(MCS11) 16-QAM	1/2	-16	-22
(MCS12) 16-QAM	3/4	-19	-24
(MCS13) 64-QAM	2/3	-22	-26
(MCS14) 64-QAM	3/4	-25	-28
(MCS15) 64-QAM	5/6	-27	-30

» 802.11ac(HT80):

Modulation	Code Rate	Relative constellation error (dB) IEEE Spec. (1Tx dB)	Relative constellation error (dB) Typical (1Tx dB)
(MCS0) BPSK	1/2	-5	-15
(MCS1) QPSK	1/2	-10	-18
(MCS2) QPSK	3/4	-13	-20
(MCS3) 16-QAM	1/2	-16	-22
(MCS4) 16-QAM	3/4	-19	-24
(MCS5) 64-QAM	2/3	-22	-26
(MCS6) 64-QAM	3/4	-25	-28
(MCS7) 64-QAM	5/6	-27	-30
(MCS8) BPSK	3/4	-30	-32
(MCS9) QPSK	5/6	-32	-33.5

Sensitivity

	Modulation	Code Rate	IEEE Spec (1Rx dBm)	Typical (1Rx dBm)
802.11a	BPSK	1/2	-82	-88
	BPSK	3/4	-81	-86
	QPSK	1/2	-79	-84
	QPSK	3/4	-77	-82
	16-QAM	1/2	-74	-78
	16-QAM	3/4	-70	-76
	64-QAM	2/3	-66	-72
	64-QAM	3/4	-65	-70
802.11b	DBPSK		not specified	-92
	DQPSK		not specified	-90
	CCK		not specified	-86
802.11g	BPSK	1/2	-82	-90
	BPSK	3/4	-81	-88
	QPSK	1/2	-79	-86
	QPSK	3/4	-77	-84
	16-QAM	1/2	-74	-82
	16-QAM	3/4	-70	-78
	64-QAM	2/3	-66	-74
	64-QAM	3/4	-65	-72
802.11ng (HT20)	(MCS0) BPSK	1/2	-82	-88
	(MCS1) QPSK	1/2	-79	-86
	(MCS2) QPSK	3/4	-77	-82
	(MCS3) 16-QAM	1/2	-74	-80
	(MCS4) 16-QAM	3/4	-70	-76
	(MCS5) 64-QAM	2/3	-66	-73
	(MCS6) 64-QAM	3/4	-65	-71
	(MCS7) 64-QAM	5/6	-64	-69

802.11ng	(MCS0) BPSK	1/2	-79	-86
(HT40)	(MCS1) QPSK	1/2	-76	-82
	(MCS2) QPSK	3/4	-74	-80
	(MCS3) 16-QAM	1/2	-71	-77
	(MCS4) 16-QAM	3/4	-67	-74
	(MCS5) 64-QAM	2/3	-63	-69
	(MCS6) 64-QAM	3/4	-62	-68
	(MCS7) 64-QAM	5/6	-61	-66
802.11na	(MCS0) BPSK	1/2	-82	-86
(HT20)	(MCS1) QPSK	1/2	-79	-84
	(MCS2) QPSK	3/4	-77	-82
	(MCS3) 16-QAM	1/2	-74	-80
	(MCS4) 16-QAM	3/4	-70	-77
	(MCS5) 64-QAM	2/3	-66	-71
	(MCS6) 64-QAM	3/4	-65	-70
	(MCS7) 64-QAM	5/6	-64	-69
802.11na	(MCS0) BPSK	1/2	-79	-84
(HT40)	(MCS1) QPSK	1/2	-76	-80
	(MCS2) QPSK	3/4	-74	-78
	(MCS3) 16-QAM	1/2	-71	-75
	(MCS4) 16-QAM	3/4	-67	-71
	(MCS5) 64-QAM	2/3	-63	-67
	(MCS6) 64-QAM	3/4	-62	-66
	(MCS7) 64-QAM	5/6	-61	-64
802.11ac	(MCS0) BPSK	1/2	-76	-80
(HT80)	(MCS1) QPSK	1/2	-73	-77
	(MCS2) QPSK	3/4	-71	-75
	(MCS3) 16-QAM	1/2	-68	-72
	(MCS4) 16-QAM	3/4	-64	-68
	(MCS5) 64-QAM	2/3	-60	-64
	(MCS6) 64-QAM	3/4	-59	-63
	(MCS7) 64-QAM	5/6	-58	-62
	(MCS8) 256-QAM	3/4	-53	-59
	(MCS9) 256-QAM	5/6	-51	-56

Transmit Spectrum Mask

For transmitted spectral mask for 11b shall be less than −50dBr for 22MHz<f<fc+22MHz.

For transmitted spectral mask for 11g shall be less than −40dBr for fc−30MHz<f<fc+30MHz.

For transmitted spectral mask for 11n 20MHz shall be less than −45dBr for fc−30MHz<f<fc+30MHz.

For transmitted spectral mask for 11n 40MHz shall be less than −45dBr for fc−60MHz<f<fc+60MHz.

Transmit Spectrum Flatness

For 802.11g the average energy of the constellations in each of spectral lines −16..-1 and +1..+16 will deviate no more than +/- 2dB from their average energy.

For 802.11n 40MHz mode, the average energy of the constellations in each of spectral lines −42..-2 and +2..+42 will deviate no more than +/- 2dB from their average energy.

The transmitted spectral flatness should be within +2/- 4dB.

Transmit Center Frequency Tolerance

The transmitted center frequency tolerance shall be ±20 ppm maximum.

Carrier Suppression

» 802.11a:

The leakage of the center frequency component shall not exceed -15 dB relative to overall transmitted power or, equivalently, +2 dB relative to the average energy of the rest of the sub-carriers.

» 802.11b:

The RF carrier suppression, measured at the channel center frequency, shall be at least

15 dB below the peak SIN(x)/x power spectrum.

» 802.11g:

The leakage of the center frequency component shall not exceed -15 dB relative to

rest of the sub-carriers.

» 802.11n:

For all 20 MHz modes of transmission

The leakage of the center frequency component shall not exceed -15 dB relative to overall transmitted power or, equivalently, +2 dB relative to the average energy of the rest of the sub-carriers.

For all 40 MHz modes of transmission

The center frequency leakage shall not exceed -18 dB relative to overall transmitted

power, or, equivalently, +2 dB relative to the average energy of the rest of the sub-carriers.

Transmit Power On Ramp and Power Down Ramp Time

» The transmitting power-on ramp for 10% to 90% of maximum power m shall be no greater than 2 µs.

» The transmitting power-down ramp for 90% to 10% of maximum power shall be no greater than 2 µs.

Receiver Maximum Input Level

	Modulation	Code Rate	IEEE Spec (1Rx dBm)
802.11a			>-30
802.11b	DBPSK		>-10
	DQPSK		>-10
	CCK		>-10
802.11g			>-20
802.11na			>-30
802.11ng			>-20
802.11ac			>-30

PCB Dimension

100±0.2.mm x 18.00±0.2mm x 1.0±0.1mm 4L FR4

Transfer Data Rate

- 802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps
- 802.11b: 1, 2, 5.5, 11Mbps
- 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps
- 802.11n:@800GI(400GI)
  - 20MHz BW
    - 1 Nss: 65(72.2) Mbps maximal
    - 2 Nss: 130(144.444) Mbps maximal
  - 40MHz BW
    - 1 Nss: 135(150) Mbps maximal
    - 2 Nss: 270(300) Mbps maximal
- 802.11ac:@800GI(400GI)
  - 80MHz BW
    - 1 Nss: 390(433.3) Mbps maximal
    - 2 Nss: 780(866.7) Mbps maximal

Security

WEP,WPA ,WPA2 ,AES, TKIP

Operation Temperature

-10 ~ 60°C (ambient)

Storage Temperature	- 35 ~ 70°C ,R.H:90%
Antenna	1 I-PEX connector for external WiFi0/BT antenna, 1 on-board antenna for WiFi1
PID/VID	PID: 9378, VID: 0CF3

2. Bluetooth portion:

Main chipset	QCA QCA9378 7VV
Compliance	Bluetooth v4.1 LE
Frequency Range	2402 ~ 2480MHz
Initial Carrier Frequency Tolerance	±20kHz (typical)
Modulation Technique	Frequency hopping, 1600 hops/sec
Channel Spacing	1MHz
Channels Support	79 channels
Operation Voltage	5V ±9% (including voltage ripple)

Power Consumption @25°C

	Avg (mA)	Max (mA)
Idle mode	105	200
Continuous DH5 TX	140	240
Continuous 2DH5 TX	140	240
Continuous 3DH5 TX	140	240

*Measured in PC (WIN7) platform.

Output power (dBm)

Class 1, BT output power is adjusted by FW .

Sensitivity

-80 dBm (typ.) for pi/4-DQPSK, 0.1%BER

Operation Temperature

-10 ~ 60°C (ambient)

Storage Temperature

-35 ~ 70°C , R.H. : 90%

Antenna

1 I-PEX connector for external antenna

PID/VID

PID: 3004, VID: 0CF3

Ordering Information:

DHUA-W8	802.11 ac/a/b/g/n 2x2 wifi and Bluetooth 4.1 LE combo USB module, QCA9378

Wireless radio modules are ESD sensitive, especially the components such as RF switch and the power amplifier. To avoid damage by electrostatic discharge, the following installation procedure is recommended:

» Touch your hands and the bag or tray containing the radio module to a ground point on the host board (for example one of the mounting holes).

» Install the radio module in the corresponding socket of host board.

» Install the pigtail cable in the cutout of the enclosure. This will ground the pigtail to the enclosure.

» Touch the I-PEX connector of the pigtail to the mounting hole (discharge), then plug onto the radio module.

» Use external lightning protection for outdoor applications.

» Make sure all antennas are being connected with the radio module (don't leave I-PEX connector open) before powering on the host device.