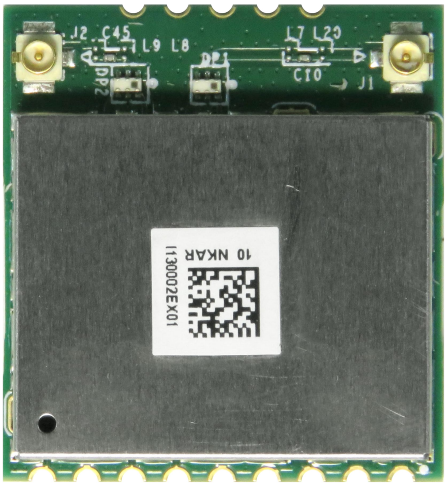
DHUA-W8S Information Sheet

802.11 ac/a/b/g/n 2x2 wifi and Bluetooth 4.1 combo USB stamp module, QCA9378-7



Overview:

DHUA-W8S is an 802.11 ac/a/b/g/n dual band 2x2 wifi and Bluetooth combo USB stamp 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 Wi-Fi/Bluetooth coexistence to ensure the best possible wireless experience, maximum performance, and lowest power consumption.

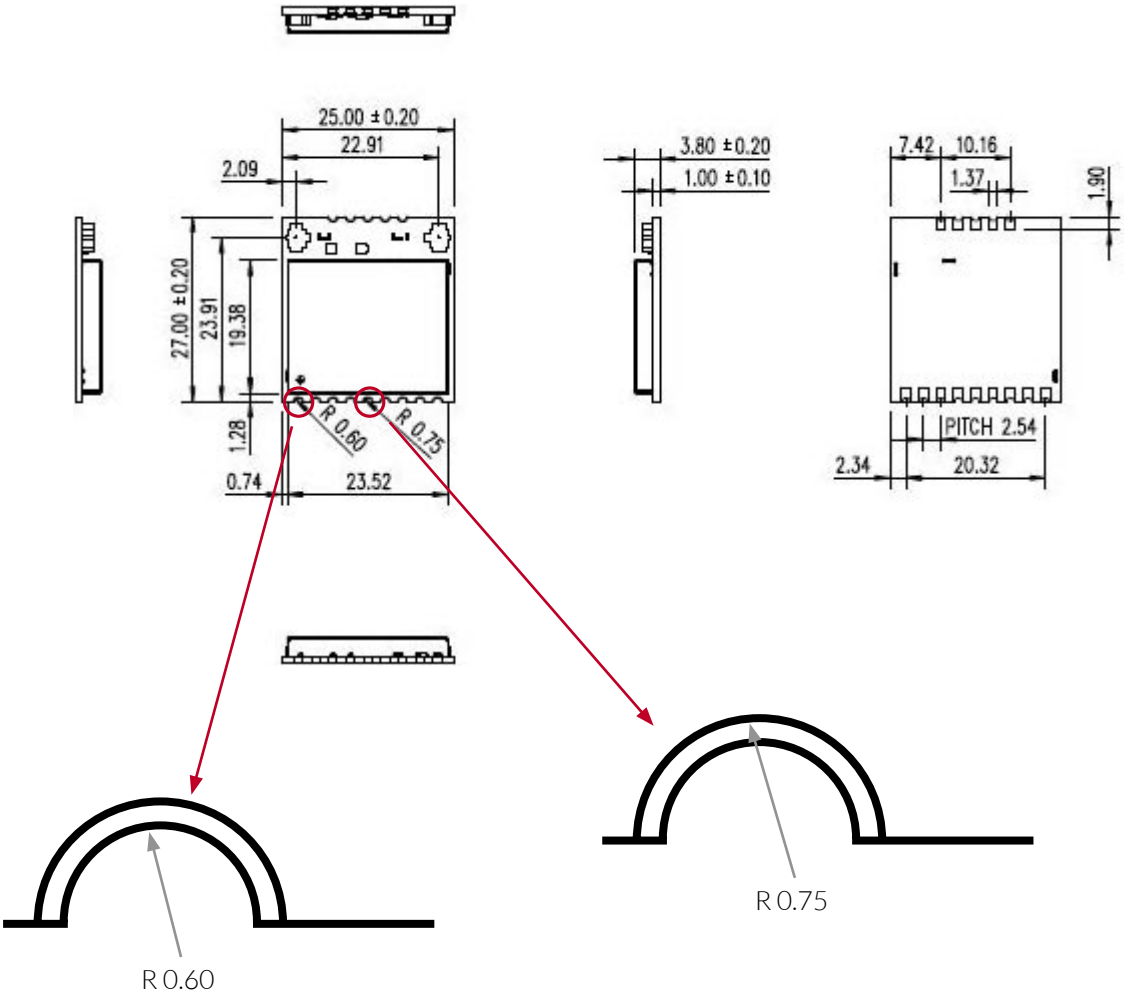
Features:

- High integrated dual-band (2.4/5GHz) 802.11 ac/a/b/g/n 2Tx/2Rx Wi-Fi 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).
- Supports Bluetooth 4.1 (BDR/EDR/LE).
- 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.
- Two I-PEX connectors for external antenna enable highest design flexibility.
- Individual power calibration ensures high performance and stable quality.
- RoHS and REACH compliances meet environment-friendly requirement.

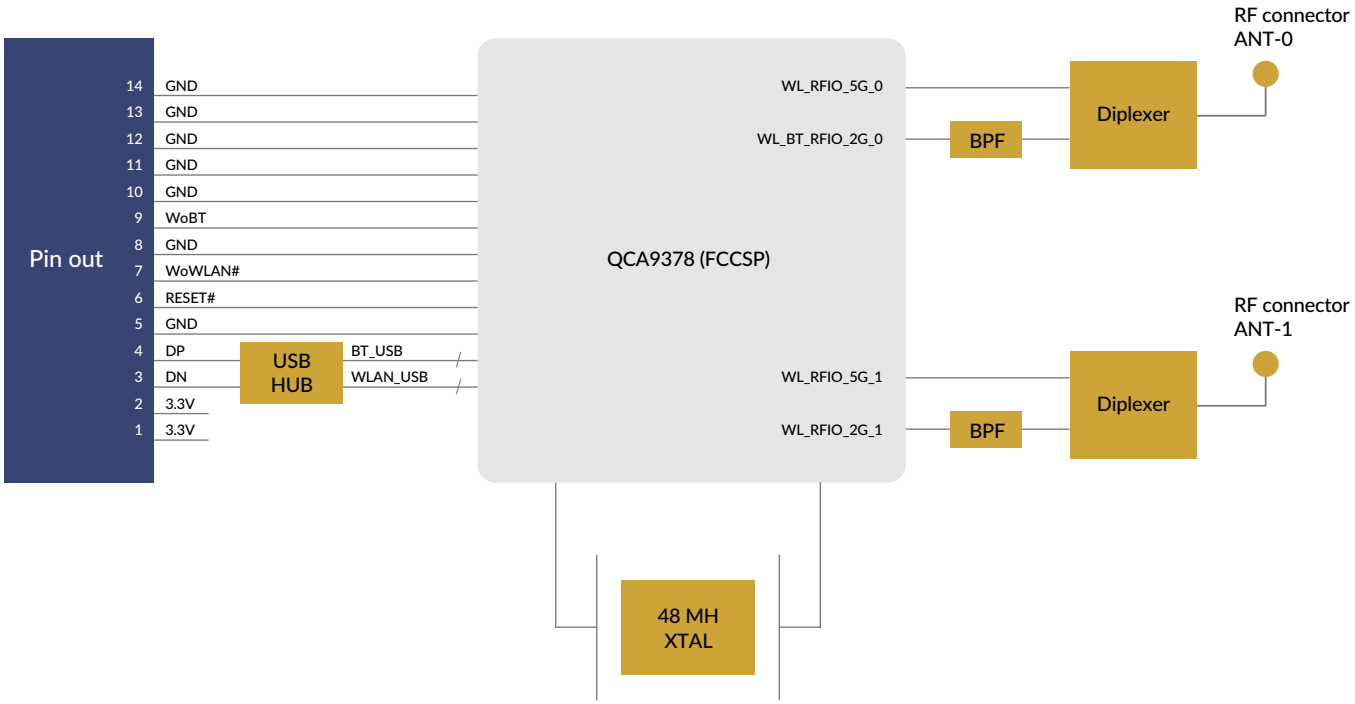
Interfaces and Power Supply:

- 14 pins I/O stamp module
- WLAN/Bluetooth RF interface
- USB interface (USB 2.0 for WLAN, and USB 1.1 for Bluetooth)
- 3.3V/1.5A power supply required

Outline:

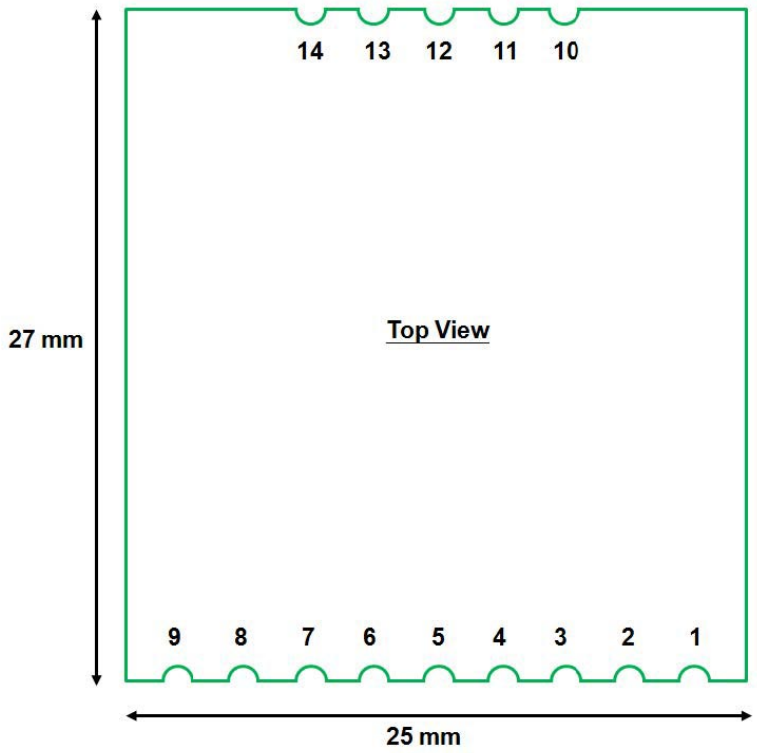

25.00 ±0.20
22.91
2.09
27.00 ±0.20
23.91
19.38
1.28
0.74
23.52
R 0.60
R 0.75
3.80 ±0.20
1.00 ±0.10
7.42
10.16
1.37
1.90
PITCH 2.54
2.34
20.32
R 0.60
R 0.75

Block Diagram:



Pin Assignment:

Pin No.	Pin Name	Remark	I/O
1	+3.3V		I
2	+3.3V		I
3	USB_D-		I/O
4	USB_D+		I/O
5	GND		-
6	RESET#		I
7	WOWLAN#		O
8	GND		-
9	WOBT#		O
10	GND		-
11	GND		-
12	GND		-
13	GND		-
14	GND		-



Specifications:

1. WiFi portion:

Main Chipset	QCA QCA9378-7
TX/RX	2T2R
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 (Complementary Code 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	3.3 V DC ±5% (including voltage ripple)

Current consumption @3.3V, 25° C

Mode	Average		Peak	
	2.4 GHz	5 GHz	2.4 GHz	5 GHz
WLAN Tx	850mA	1080mA	960mA	1260mA
WLAN Rx	160mA	160mA	280mA	280mA
Driver disable	110mA		220mA	
Standby WLAN+BT	100mA		200mA	

*WLAN Tx/Rx means continuous Tx/Rx

**Current consumption, measured on PC platform.

The maximum power-on inrush current consumption is 1.5A within 10us.

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 onstellations 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 with in +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 overall transmitted power or, equivalently, +2 dB relative to the average energy of the 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

Dimension

27±0.2.mm x 25±0.2mm x 3.8±0.2mm

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) Note: Customer is highly recommended to conduct thermal verification if the module mainly acts on high-duty transmission (Tx) on small mainboard with ambient temperature near to 60°C
Storage Temperature	- 35 ~ 70°C ,R.H:90%
RF port	2 RF connector for external antenna (ANT-0 and ANT1)
PID/VID	PID: 9378, VID: 0CF3
Regulation Compliance	FCC, IC, others by request
Health & Environment-Friendly	RoHS, REACH

2. Bluetooth portion:

Main chipset	QCA QCA9378-7
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 for Bluetooth, 40 channels for BLE
Operation Voltage	3.3V ± 5% (including voltage ripple)

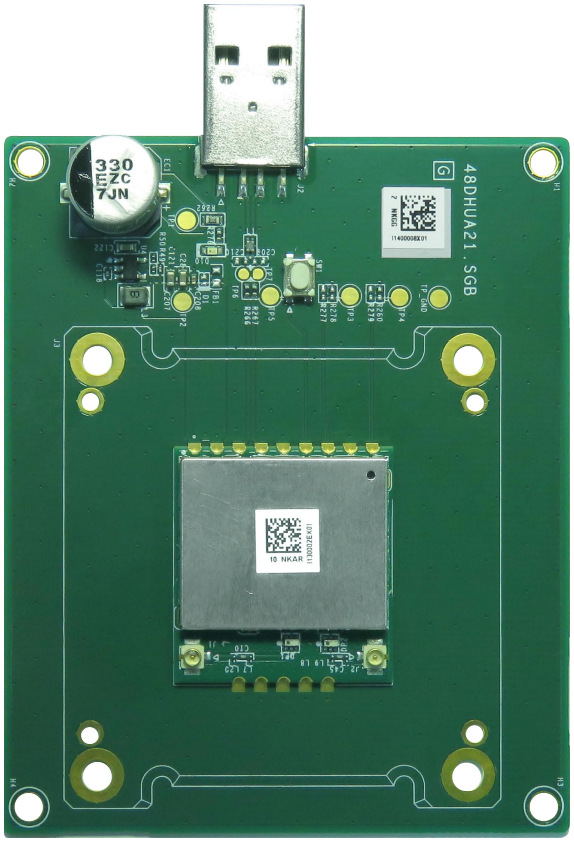
Current consumption @3.3V, 25°C

	Avg (mA)	Max (mA)
Idle mode	160	310
Continuous DH5 TX	220	370
Continuous 2DH5 TX	220	370
Continuous 3DH5 TX	220	370

*Measured on PC 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) Note: Customer is highly recommended to conduct thermal verification if the module mainly acts on high-duty transmission (Tx) on small mainboard with ambient temperature near to 60°C
Storage Temperature	-35 ~ 70°C , R.H. : 90%
RF port	1 RF connector (co-used with WLAN ANT-0) for external antenna
PID/VID	PID: 3004, VID: 0CF3
Regulation Compliance	FCC, IC, others by request
Health & Environment-Friendly	RoHS, REACH

Evaluation board (DHUA-W8S-EVB)



Ordering Information:

DHUA-W8S	802.11 ac/a/b/g/n 2x2 wifi and Bluetooth 4.1 combo USB stamp module, QCA9378-7
DHUA-W8S-EVB	DHUA-W8S evaluation board

Note: Customer is highly recommended to order DHUA-W8S quantities with multiples of 300 units due to each reel vacuum bag contains 300 units.

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.