

BW3456-44B1

IEEE 802.11a/b/g/n/ac 1T1R+BT5.2 Combo Module

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1. Device Overview

1.1 Features

1.1.1 General Features

- Supports battery voltage range from 3.0V to 4.8V supplies with internal switching regulator
- 1 antennas to support 1T1R technology and Bluetooth
- WPA and WPA2 support for powerful encryption and authentication
- AES and TKIP in hardware for faster data encryption and IEEE 802.11i compatibility
- Reference WLAN subsystem provides Cisco Compatible Extensions(CCX,CCX 2.0 CCX 3.0 ,and CCX 4.0)
- Reference WLAN subsystem provides Wi-Fi Protected Setup (WPS)Support external crystal and internal crystal
- Support standard SDIO v3.0(including DDR50 mode at 50Mhz and SDR104 mode at 208Mhz ,b-bit and 1bit)interfaces.
- Backward compatible with SDIO v2.0 host interfaces.
- Interface support ,host controller interface(HCI) using a high speed UART interface and PCM for audio data .12.0mm*12.0mm LGA package

1.1.2 IEEE 802.11x Key Features

- IEEE 802.11ac compliant
- Single-stream spatial multiplexing up to 433.3 Mbps data rate .
- Programmable data rates from MCS0–MCS9 in 20, 40, and 80 MHz channels, as specified in IEEE 802.11ac
- Full IEEE 802.11a/b/g/n legacy compatibility with enhanced performance
- TX and RX low-density parity check (LDPC) support for improved range and power efficiency
- Supports explicit IEEE 802.11ac transmit beamforming
- Supports Optional Short GI and Green Field modes in TX and RX
- Supports IEEE 802.15.2 external coexistence interface to optimize bandwidth utilization with other co-located wireless technologies such as LTE or GPS.

1.1.3 Bluetooth Key Features

- Complies with Bluetooth Core Specification Version 4.2 with provisions for supporting future specifications.Bluetooth Class 1 or Class 2 transmitter operation
- Supports multiple simultaneous Advanced Audio Distribution Profiles (A2DP) for stereo sound
- Low power consumption improves battery life of handheld
- Adaptive frequency hopping(AFH) for reducing radio frequency interference
- Automatic frequency detection for standard crystal and TCXO values

1.2 Descriptions

The BW3456-44B1 module is a complete dual-band (2.4 GHz and 5 GHz) Wi-Fi 1 × 1 MAC/baseband/Radio System-on-a-Module. It provides the highest level of integration for IoT applications handheld wireless systems. In IEEE 802.11ac mode, the WLAN operation supports rates of MCS0–MCS9 (up to 256 QAM) in 20 MHz, 40MHz, and 80 MHz channels for data rates up to 433.3 Mbps. In addition, all the IEEE 802.11a/b/g/n rates are supported.

1.3 Functional Block Diagram

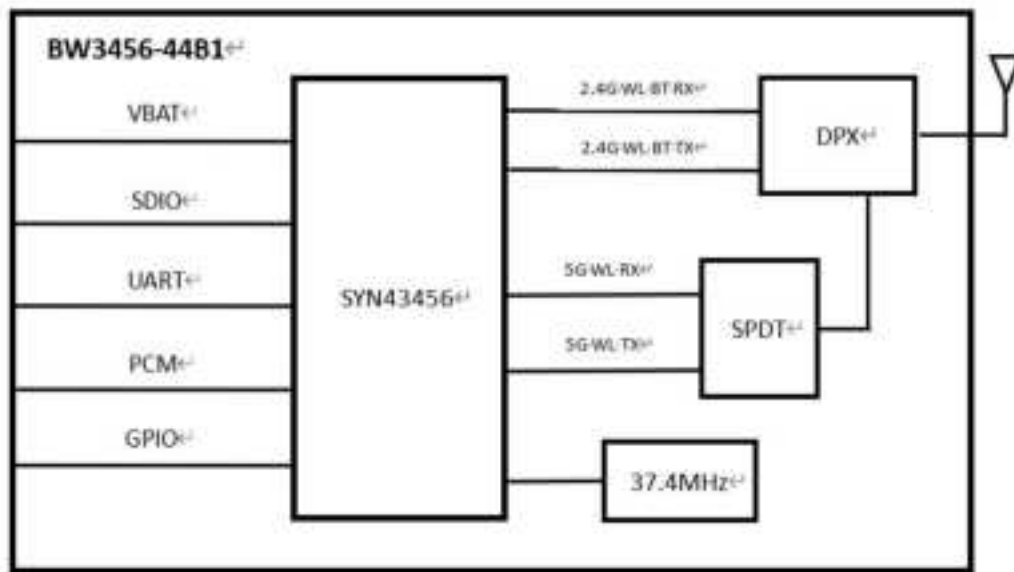


Figure 1. Block Diagram of BW3456-44B1

2. Pin Configuration and Functions

2.1 Module Pin Diagram

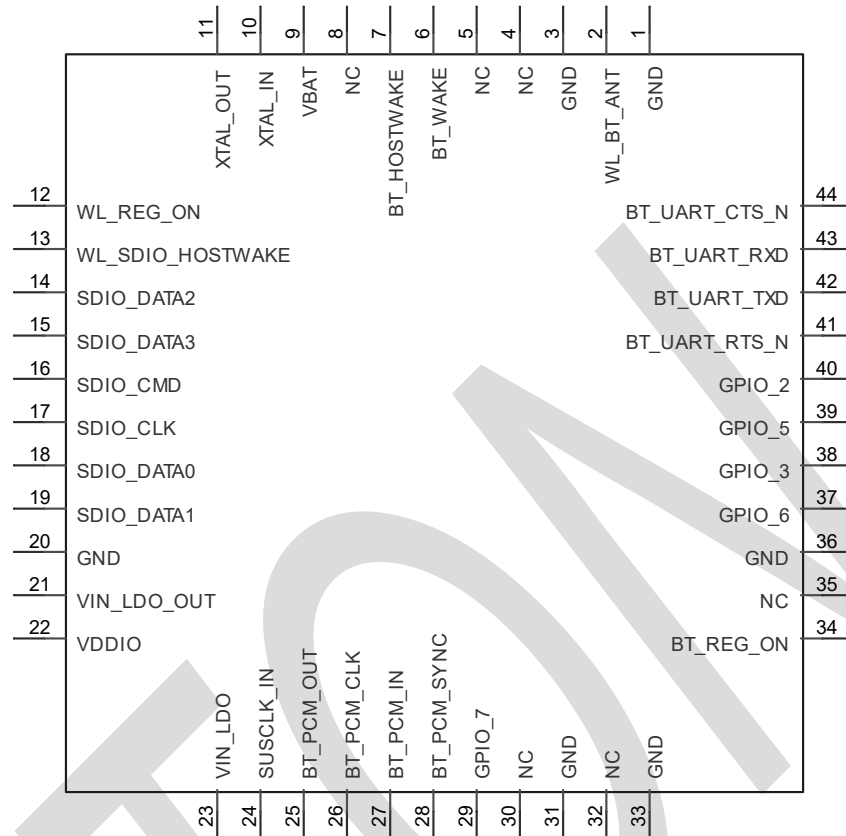


Figure 2.Pin Diagram of BW3456-44B1

2.2 Pin Functions

Pin	Name	Description
1	GND	Ground
2	WL_BT_ANT	WLAN/BT RF TX/RX path
3	GND	Ground
4	NC	No connected
5	NC	No connected
6	BT_WAKE	BT Device Wake
7	BT_HOSTWAKE	BT Host Wake
8	NC	No connected
9	VBAT	3.3V power supply
10	XTAL_IN	No connected
11	XTAL_OUT	No connected

12	WL_REG_ON	Used by PMU to power up or power down the internal regulators used by the WLAN section. Also, when deasserted, this pin holds the WLAN section in reset. This pin has an internal 200k ohm pull down resistor that is enabled by default. It can be disabled through programming
13	WL_SDIO_HOSTWAKE	WL Host Wake
14	SDIO_DATA2	SDIO Data Line 2
15	SDIO_DATA3	SDIO Data Line 3
16	SDIO_CMD	SDIO Command Input
17	SDIO_CLK	SDIO Clock Input
18	SDIO_DATA0	SDIO Data Line 0
19	SDIO_DATA1	SDIO Data Line 1
20	GND	Ground
21	VIN_LDO_OUT	Internal Buck voltage generation pin
22	VDDIO	1.8V-3.3V VDDIO supply for WLAN and BT
23	VIN_LDO	Internal Buck voltage generation pin
24	SUSCLK_IN	External 32K or RTC clock
25	BT_PCM_OUT	PCM data Out
26	BT_PCM_CLK	PCM Clock
27	BT_PCM_IN	PCM data Input
28	BT_PCM_SYNC	PCM Synchronization control
29	GPIO_7	SDIO mode selection pin 1.8V:pull up, connect to 1.8V 3.3V:pull down, connect to GND with using a 10K resistor or less
30	NC	No connected
31	GND	Ground
32	NC	No connected
33	GND	Ground
34	BT_REG_ON	Used by PMU to power up or power down the internal regulators used by the Bluetooth section. Also, when deasserted, this pin holds the Bluetooth section in reset. This pin has an internal 200k ohm pull down resistor that is enabled by default. It can be disabled through programming
35	NC	No connected
36	GND	Ground
37	GPIO_6	GPIO configuration pin
38	GPIO_3	GPIO configuration pin

39	GPIO_5	GPIO configuration pin
40	GPIO_2	GPIO configuration pin
41	BT_UART_RTS_N	High-Speed UART RTS
42	BT_UART_TXD	High-Speed UART Data Out
43	BT_UART_RXD	High-Speed UART Data In
44	BT_UART_CTS_N	High-Speed UART CTS

3. Specifications

3.1 General Characteristics

Category	Descriptions
Dimension	L*W*H :12.0mm (±0.2mm)*12.0mm (±0.2mm)*2.1mm (±0.1mm)
Chip-set	SYN43456
Standard	IEEE 802.11a/b/g/n/ac+BT 5.2
Modulation Type	CCK, OFDM(16 QAM/64 QAM/256 QAM)
Frequency Band	2400~2500MHz,4900-5845MHz
Interface	WLAN:SDIO, Bluetooth:UART
Spread Spectrum	DSSS
Transmission Distance	Indoor up to 100m, outdoor up to 300m (limited in an environment)
Data Security	WEP,WPA/WPA2
Transmit Power(Conducted)	2.4G: 11b 11Mbps:17±2dBm 11b 11Mbps:17±2dBm 11g 6Mbps:16±2dBm 11g 54Mbps:15±2dBm 11n HT20 MCS0:17±2dBm 11n HT20 MCS7:14±2dBm 5G: 11a 6Mbps:17±2dBm 11a 54Mbps:15±2dBm 11n HT20 MCS0:17±2dBm 11n HT20 MCS7:14±2dBm 11n HT40 MCS0:17±2dBm 11n HT40 MCS7:14±2dBm 11ac VHT20 MCS0:17±2dBm 11ac VHT20 MCS8:12±2dBm 11ac VHT40 MCS0:17±2dBm 11ac VHT40 MCS9:11±2dBm

	11ac VTH80 MCS0:17±2dBm 11ac VTH80 MCS9:11±2dBm
Rx Sensitivity	2.4G: 11b 11M:-87dBm@8% PER 11g 54M: -76dBm@10% PER 11n HT20 MCS7: -74dBm@10% PER 11n HT40 MCS7: -71dBm@10% PER 5G: 11a 54M:-73dBm@10% PER 11n HT20 MCS7: -71dBm@10% PER 11n HT40 MCS7: -68dBm@10% PER 11ac VTH20 MCS8:-66dBm@10% PER 11ac VTH40 MCS9:-63dBm@10% PER 11ac VTH80 MCS9:-59dBm@10% PER
Data Rate	802.11b [11,5.5,2 and 1Mbps] 802.11g [54,48,36,24,18,12,9&6Mbps] 802.11n HT20:up to 72.2Mbps 802.11n HT40:up to 150Mbps 802.11ac VHT80:up to 433.3Mbps
Frequency Error	2.4GHz:<±25 ppm(11b),<±20 ppm(11g/n);5GHz:<±20 ppm
Ambient Temperature	-30℃~85℃
Storage Temperature	-40℃~125℃
Antenna	External PF antenna
Operating System	Linux
Operating Voltage	VBAT: 3.0 ~ 4.8V ; typical: 3.6V VIO : 1.8 ~ 3.3V

3.2 RF Characteristics

All measurements are made under nominal supply voltage & room temperature, and conducted conditions at antenna port rather than antenna.

3.2.1 Receiver RF Specifications

Parameter	Conditions		Min.	Nom.	Max.	Unit
Receive Input Frequency						
2.4GHz	802.11b/g/n mode		2400	-	2500	MHz
Receiver Sensitivity						
802.11b	1Mbps	FER<8%, Packet size= 1,024bytes	-	-	-82	dBm
	2Mbps		-	-	-80	dBm
	5.5Mbps		-	-	-78	dBm
	11Mbps		-	-	-76	dBm

802.11g	6Mbps	PER<10%, Packet size= 1,024bytes	-	-	-82	dBm
	9Mbps		-	-	-81	dBm
	12Mbps		-	-	-79	dBm
	18Mbps		-	-	-77	dBm
	24Mbps		-	-	-74	dBm
	36Mbps		-	-	-70	dBm
	48Mbps		-	-	-66	dBm
	54Mbps		-	-	-65	dBm
802.11n (HT20)	MCS0.	PER<10%, Packet size= 4,096bytes	-	-	-80	dBm
	MCS1.		-	-	-77	dBm
	MCS2		-	-	-75	dBm
	MCS3.		-	-	-72	dBm
	MCS4.		-	-	-68	dBm
	MCS5.		-	-	-64	dBm
	MCS6.		-	-	-63	dBm
	MCS7.		-	-	-62	dBm
802.11n (HT40)	MCS0.	PER<10%, Packet size= 4,096bytes	-	-	-77	dBm
	MCS1.		-	-	-74	dBm
	MCS2		-	-	-72	dBm
	MCS3.		-	-	-69	dBm
	MCS4.		-	-	-65	dBm
	MCS5.		-	-	-61	dBm
	MCS6.		-	-	-60	dBm
	MCS7.		-	-	-59	dBm
Maximum Input Level						
802.11b	FER<8%		-10	-	-	dBm
802.11g	FER<10%		-20	-	-	dBm
802.11n	FER<10%		-30			dBm

Parameter	Conditions		Min.	Nom.	Max.	Unit
Receive Input Frequency						
5GHz	802.11a/n/ac mode		4900	-	5845	MHz
Receiver Sensitivity						
802.11a	6Mbps	FER<10%, Packet size= 1,024bytes	-	-	-82	dBm
	9Mbps		-	-	-81	dBm
	12Mbps		-	-	-79	dBm
	18Mbps		-	-	-77	dBm
	24Mbps		-	-	-74	dBm
	36Mbps		-	-	-70	dBm

	48Mbps		-	-	-66	dBm
	54Mbps		-	-	-65	dBm
802.11n (HT20)	6Mbps	PER<10%, Packet size= 4,096bytes	-	-	-80	dBm
	9Mbps		-	-	-77	dBm
	12Mbps		-	-	-75	dBm
	18Mbps		-	-	-72	dBm
	24Mbps		-	-	-68	dBm
	36Mbps		-	-	-64	dBm
	48Mbps		-	-	-63	dBm
	54Mbps		-	-	-62	dBm
802.11n (HT40)	MCS0.	PER<10%, Packet size= 4,096bytes	-	-	-77	dBm
	MCS1.		-	-	-74	dBm
	MCS2		-	-	-72	dBm
	MCS3.		-	-	-69	dBm
	MCS4.		-	-	-65	dBm
	MCS5.		-	-	-61	dBm
	MCS6.		-	-	-60	dBm
	MCS7.		-	-	-59	dBm
802.11ac (VHT80)	MCS0.	PER<10%, Packet size= 4,096bytes	-	-	-76	dBm
	MCS1.		-	-	-73	dBm
	MCS2		-	-	-71	dBm
	MCS3.		-	-	-68	dBm
	MCS4.		-	-	-64	dBm
	MCS5.		-	-	-60	dBm
	MCS6.		-	-	-59	dBm
	MCS7.		-	-	-58	dBm
	MCS8.		-	-	-53	dBm
	MCS9.		-	-	-51	dBm
Maximum Input Level						
802.11a	FER<10%		-30	-	-	dBm
802.11n	FER<10%		-30	-	-	dBm
802.11ac	FER<10%		-30	-	-	dBm

3.2.2 Transmitter RF Specifications

Parameter	Condition	Min.	Nom.	Max.	Unit.
Receive Input Frequency					
802.11b/g/n	2.4GHz	2400	-	2500	MHz
Transmit Power					
802.11b	11Mbps	15	17	19	dBm
802.11g	54Mbps	13	15	17	dBm
802.11n	HT20, MCS7	12	14	16	dBm
	HT40, MCS7	12	14	16	dBm

Spectrum Mask					
802.11b	$f_c-22\text{MHz}<f<f_c-11\text{MHz}\&f_c+11\text{MHz}<f<f_c+22\text{MHz}$	-	-	-30	dBr
	$f_c-55\text{MHz}<f<f_c-22\text{MHz}\&f_c+22\text{MHz}<f<f_c+55\text{MHz}$	-	-	-50	dBr
802.11g	$f_c\pm 9\text{MHz}$	-	-	0	dBr
	$f_c\pm 11\text{MHz}$	-	-	-20	dBr
	$f_c\pm 20\text{MHz}$	-	-	-28	dBr
	$f_c\pm 30\text{MHz}$	-	-	-40	dBr
802.11n	$f_c\pm 9\text{MHz}$	-	-	0	dBr
	$f_c\pm 11\text{MHz}$	-	-	-20	dBr
	$f_c\pm 20\text{MHz}$	-	-	-28	dBr
	$f_c\pm 30\text{MHz}$	-	-	-45	dBr
Center Frequency Tolerance					
802.11b		-25	-	+25	pmm
802.11g/n		-20	-	+20	pmm
EVM(Error Vector Magnitude)*					
802.11b	1Mbps	-	-	35	%
	2Mbps	-	-	35	%
	5.5Mbps	-	-	35	%
	11Mbps	-	-	35	%
802.11g	6Mbps	-	-	-5	%
	9Mbps	-	-	-8	dB
	12Mbps	-	-	-10	dB
	18Mbps	-	-	-13	dB
	24Mbps	-	-	-16	dB
	36Mbps	-	-	-19	dB
	48Mbps	-	-	-22	dB
	54Mbps	-	-	-25	dB
802.11n	MCS0.	-	-	-5	dB
	MCS1.	-	-	-10	dB
	MCS2	-	-	-13	dB
	MCS3.	-	-	-16	dB
	MCS4.	-	-	-19	dB
	MCS5.	-	-	-22	dB
	MCS6.	-	-	-25	dB
	MCS7.	-	-	-28	dB
Remarks					

EVM :

<Test condition>

Method: composite EVM method.

Phase correction: Symbol-by-symbol correction.

Channel estimation: Raw channel estimate Raw Long Symbols.

Symbol timing correction: on.

Frequency Sync: Long training symbol.

Parameter	Condition	Min.	Nom.	Max.	Unit.
Receive Input Frequency					
802.11a/n/ac	5GHz	4900	-	5845	MHz
Transmit Power					
802.11a	54Mbps	13	15	17	dBm
802.11n	HT20, MCS7	12	14	16	dBm
	HT40, MCS7	12	14	16	dBm
802.11ac	VHT20,MCS8	10	12	14	dBm
	VHT40,MCS9	9	11	13	dBm
	VHT80,MCS9	9	11	13	dBm
Spectrum Mask					
802.11a	$f_c \pm 9\text{MHz}$	-	-	0	dBr
	$f_c \pm 11\text{MHz}$	-	-	-20	dBr
	$f_c \pm 20\text{MHz}$	-	-	-28	dBr
	$f_c \pm 30\text{MHz}$	-	-	-40	dBr
802.11n	$f_c \pm 9\text{MHz}$	-	-	0	dBr
	$f_c \pm 11\text{MHz}$	-	-	-20	dBr
	$f_c \pm 20\text{MHz}$	-	-	-28	dBr
	$f_c \pm 30\text{MHz}$	-	-	-45	dBr
802.11ac(VHT80)	$f_c \pm 39\text{MHz}$	-	-	0	dBr
	$f_c \pm 41\text{MHz}$	-	-	-20	dBr
	$f_c \pm 80\text{MHz}$	-	-	-28	dBr
	$f_c \pm 120\text{MHz}$	-	-	-40	dBr
Center Frequency Tolerance					
802.11a/n/ac		-20	-	+20	pmm
EVM(Error Vector Magnitude)*					
802.11a	6Mbps	-	-	-5	%
	9Mbps	-	-	-8	dB
	12Mbps	-	-	-10	dB
	18Mbps	-	-	-13	dB
	24Mbps	-	-	-16	dB
	36Mbps	-	-	-19	dB
	48Mbps	-	-	-22	dB
	54Mbps	-	-	-25	dB

802.11n	MCS0.	-	-	-5	dB
	MCS1.	-	-	-10	dB
	MCS2	-	-	-13	dB
	MCS3.	-	-	-16	dB
	MCS4.	-	-	-19	dB
	MCS5.	-	-	-22	dB
	MCS6.	-	-	-25	dB
	MCS7.	-	-	-28	dB
802.11ac	MCS0.	-	-	-5	dB
	MCS1.	-	-	-10	dB
	MCS2	-	-	-13	dB
	MCS3.	-	-	-16	dB
	MCS4.	-	-	-19	dB
	MCS5.	-	-	-22	dB
	MCS6.	-	-	-25	dB
	MCS7.	-	-	-27	dB
	MCS8.	-	-	-30	dB
	MCS9.	-	-	-32	dB
Remarks					
EVM : <Test condition> Method: composite EVM method. Phase correction: Symbol-by-symbol correction. Channel estimation: Raw channel estimate Raw Long Symbols. Symbol timing correction: on. Frequency Sync: Long training symbol.					

3.2.3 Bluetooth RF Specifications

Parameter	Conditions	Minimum	Typical	Maximum	Unit
Frequency range		2402		2480	MHz
RX sensitivity	GFSK	-	-88	-	dBm
	$\pi/4$ -DQPSK	-	-95	-	dBm
	8-DPSK	-	-88	-	dBm
Output power (Conducted)	BDR	-	8	-	dBm
	EDR	-	6	-	dBm
	LE	-	7	-	dBm

4. Application, Implementation, and Layout

4.1 Wi-Fi Application Diagram

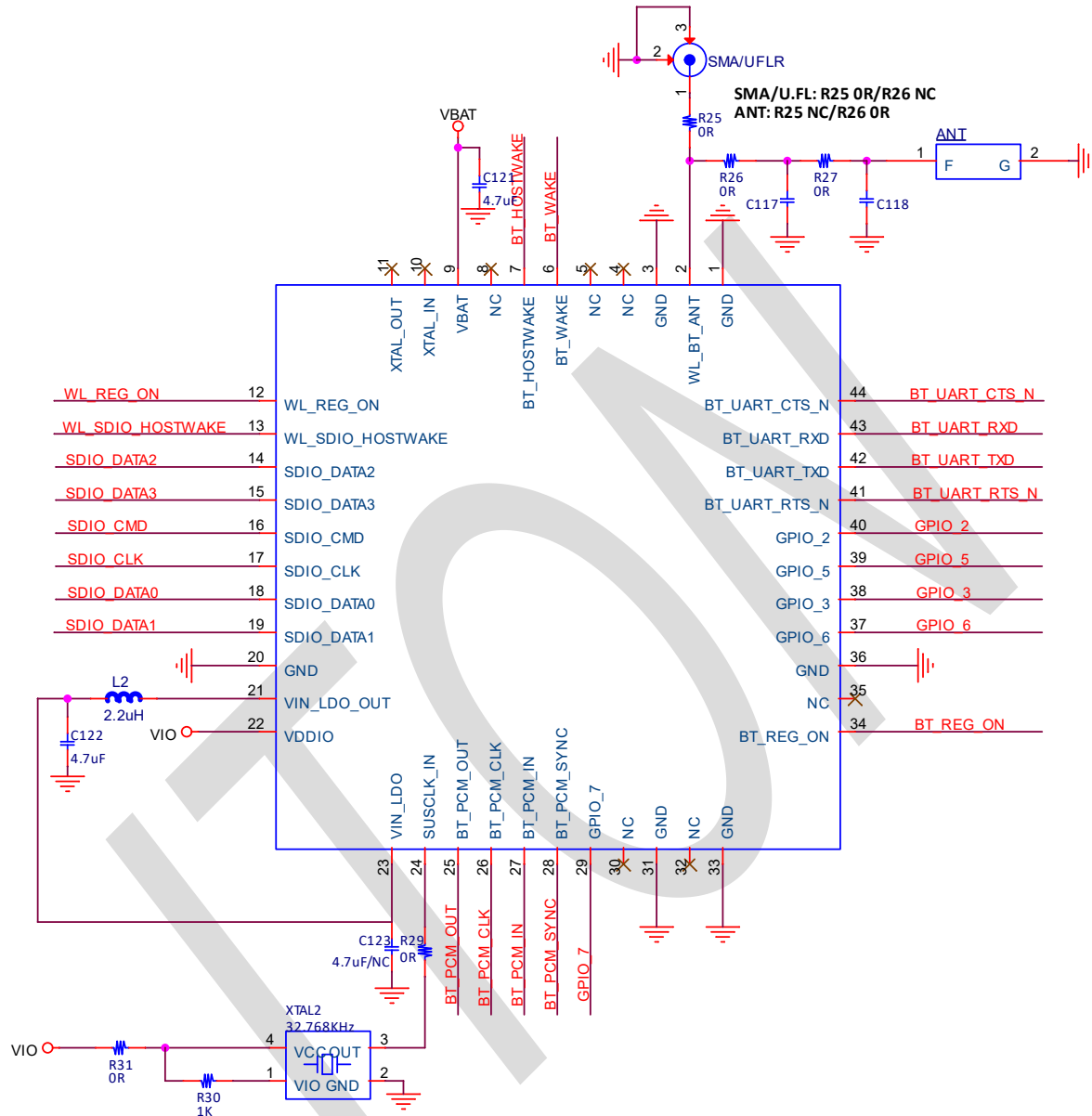


Figure 3. Application Circuit Diagram of BW3456-44B1

5. Mechanical Size, Package and Layout Recommendation

5.1 Mechanical Size

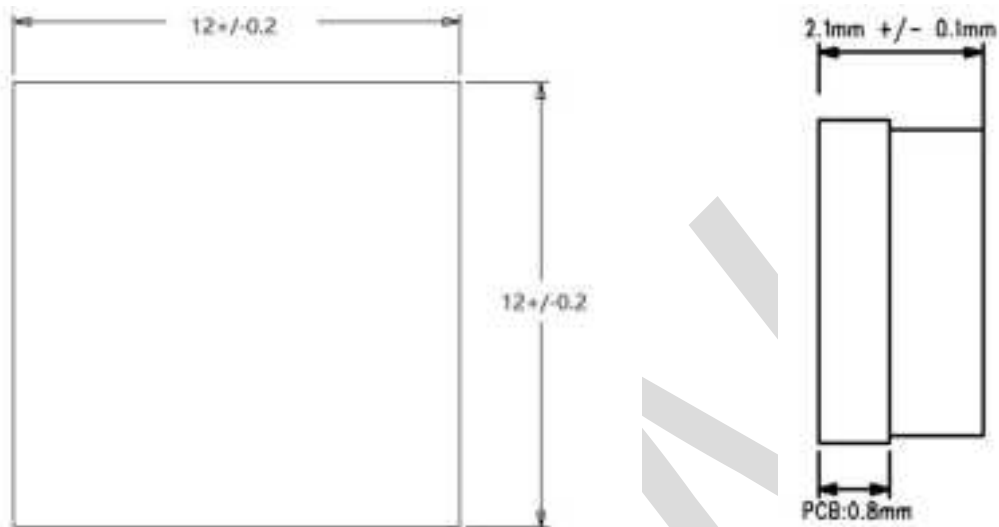
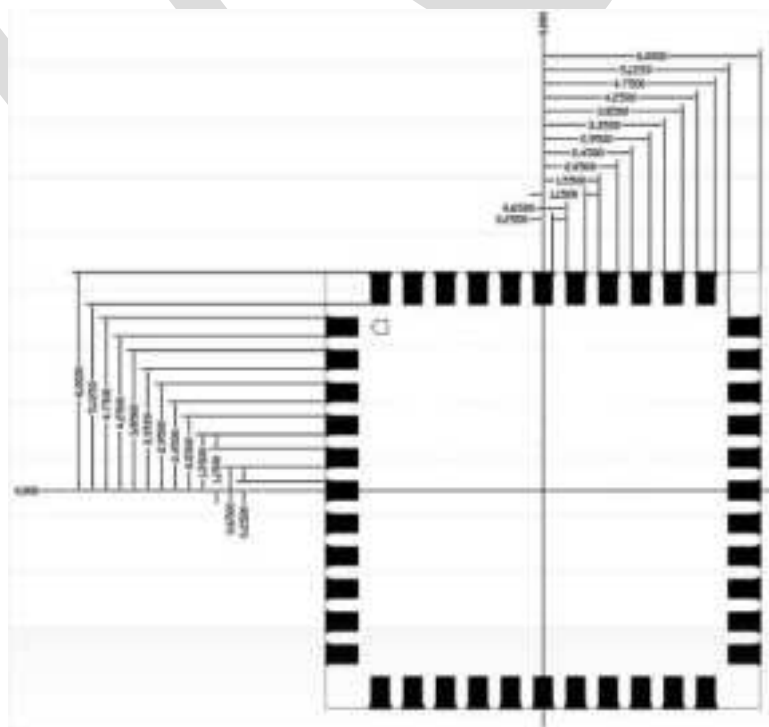


Figure 4. Mechanical Size of BW3456-44B1

5.2 Layout Recommendation

(Unit: mm)



< BOTTOM VIEW >

5.3 Package Information

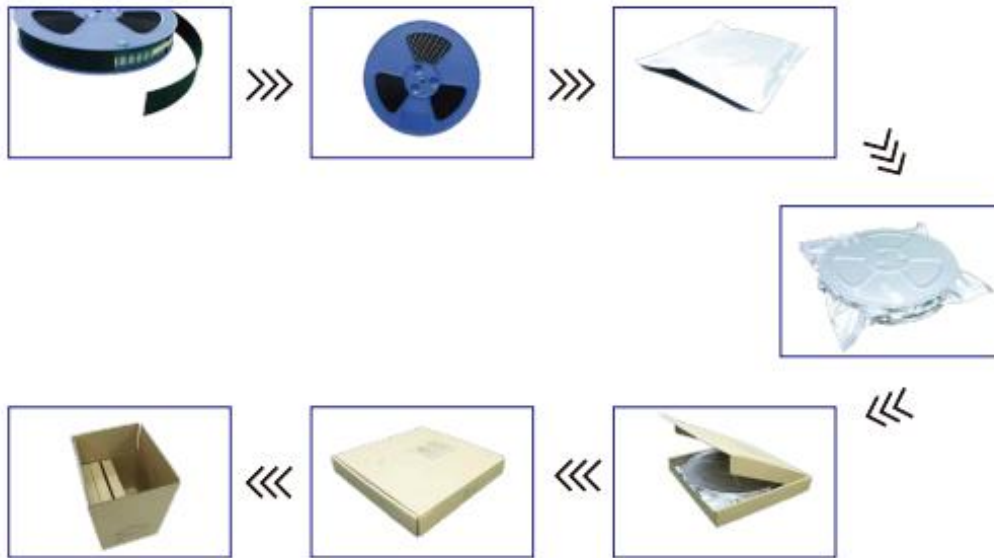


Figure 5. Brief Packaging Process of BW3456-44B1 Modules

6. Thermal Reflow

Referred to IPC/JEDEC standard.

Peak temperature: $<250^{\circ}\text{C}$

Number of times: ≤ 2

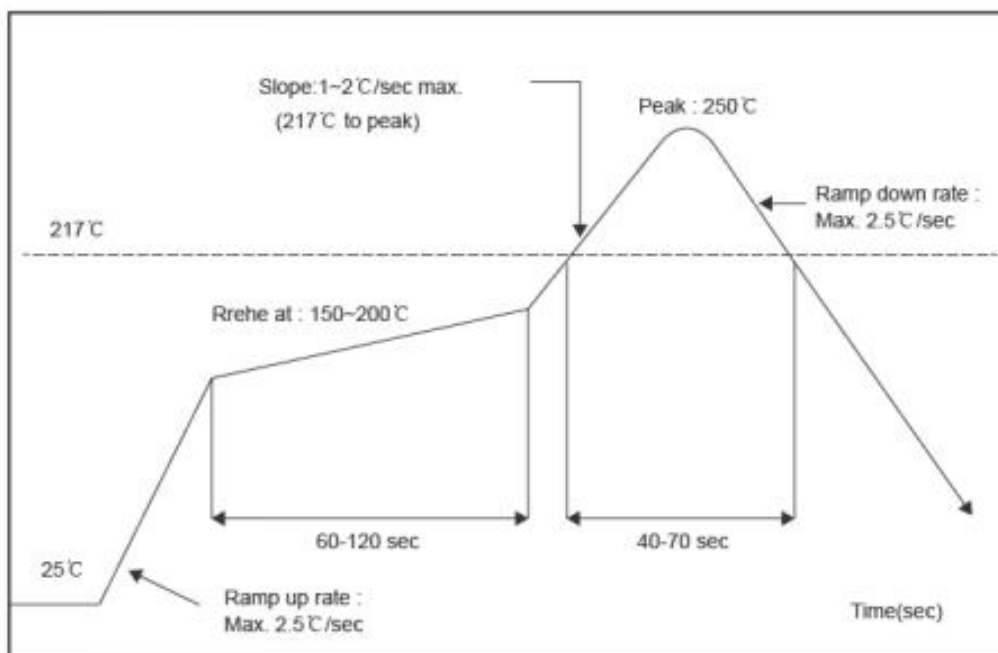


Figure 6. Recommended Reflow for Lead Free Solder

Note: The module is recommended not to go through reflow oven twice.

7. Ordering Information

Part NO.	Working Voltage	ANT	Shielding Cover	37.4M Crystal
BW3456-44B1	3.0V~4.8V DC	External antenna	Included	Yes
BW3456-44B2	3.0V~4.8V DC	External antenna	Included	No

8. Revision History

Version	Change Content	Reviser	Date
V1.0	Initial Version	Phil	2023-05-28

FCC Interference Statement

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.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

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 compliance could void the user's authority to operate the equipment

***RF warning for Mobile device:**

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.

The OEM must certify the final end product to comply with unintentional radiators (FCC Sections 15.107 and 15.109) before declaring compliance of the final product to Part 15 of the FCC rules and regulations. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change.

The OEM must comply with the FCC labeling requirements. If the module's label is not visible when installed, then an additional permanent label must be applied on the outside of the finished product which states: "Contains transmitter module FCC ID: VYVBW436S-44B1".

Additionally, the following statement should be included on the label and in the final product's user manual:

"This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interferences, and
 - (2) this device must accept any interference received, including interference that may cause undesired operation."
- The module is limited to installation in applications. Separate approval is required for all other operating configurations, including portable configuration with respect to Part 2.1093 and different antenna configurations. A module or modules can only be used without additional authorizations if they have been tested and granted under the same intended end - use operational conditions, including simultaneous transmission operations. When they have not been tested and granted in this manner, additional testing and/or FCC
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application filing may be required. The most straightforward approach to address additional testing conditions is to have the grantee responsible for the certification of at least one of the modules submit a permissive change application. When having a module grantee file a permissive change is not practical or feasible, the following guidance provides some additional options for host manufacturers. Integrations using modules where additional testing and/or FCC application filing(s) may be required are: (A) a module used in devices requiring additional RF exposure compliance information (e.g., MPE evaluation or SAR testing); (B) limited and/or split modules not meeting all of the module requirements; and (C) simultaneous transmissions for independent collocated transmitters not previously granted together. This Module is full modular approval, it is limited to OEM installation ONLY. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change. (OEM) Integrator has to assure compliance of the entire end product include the integrated Module. Additional measurements (15B) and/or equipment authorizations (e.g. Verification) may need to be addressed depending on co-location or simultaneous transmission issues if applicable. (OEM) Integrator is reminded to assure that these installation instructions will not be made available to the end user.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM

Manual v01

2.2 List of applicable FCC rules

FCC Part 15 Subpart C 15.247 & 15.407 & 15.207 & 15.209 & 15.205

2.3 Specific operational use conditions

Operation Mode	:	☒ BT BDR ☒ BT EDR
Operation Frequency	:	2402~2480MHz
Number of Channel	:	79 Channels
Modulation Type	:	GFSK, $\pi/4$ -DQPSK, 8-DPSK
Operation Mode	:	☒ BT BLE
Support Rate	:	☒ 1Mbps ☐ 2Mbps
Operation Frequency	:	2402~2480MHz
Number of Channel	:	40 Channels
Operation Mode	:	☒ 802.11b ☒ 802.11g ☒ 802.11n(HT20) ☐ 802.11n(HT40)
Operation Frequency	:	2412~2462MHz
Number of Channel	:	11 Channel for 20MHz bandwidth (2412~2462MHz)
Modulation Type	:	☒ 802.11b: DSSS (CCK, DQPSK, DBPSK) ☒ 802.11g: OFDM (BPSK, QPSK, 16QAM, 64QAM) ☒ 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM)
Operation Mode	:	☒ a ☒ n(HT20) ☒ n(HT40) ☒ ac(VHT20) ☒ ac(VHT40) ☒ ac(VHT80)
Device Type	:	☒ Client
TPC Function	:	☒ Without TPC
DFS Type	:	☒ Slave without radar detection
Operation Frequency	:	☒ Wi-Fi 5.2G: 5150~5250MHz ☒ Wi-Fi 5.3G: 5250~5350MHz ☒ Wi-Fi 5.6G: 5470~5725MHz ☒ Wi-Fi 5.8G: 5725~5850MHz
Number of Channel	:	Wi-Fi 5.2G: ☒ 4 Channels for 20MHz bandwidth (5180-5240MHz) ☒ 2 Channels for 40MHz bandwidth (5190-5230MHz) ☒ 1 Channels for 80MHz bandwidth (5210MHz) Wi-Fi 5.3G: ☒ 4 Channels for 20MHz bandwidth (5260-5320MHz) ☒ 2 Channels for 40MHz bandwidth (5270-5310MHz) ☒ 1 Channels for 80MHz bandwidth (5290MHz)

	Wi-Fi 5.6G: ☒ 11 Channels for 20MHz bandwidth (5500-5700MHz) ☒ 5 Channels for 40MHz bandwidth (5510-5670MHz) ☒ 2 Channels for 80MHz bandwidth (5530~5610MHz) Wi-Fi 5.8G: ☒ 5 Channels for 20MHz bandwidth (5745MHz ~ 5825MHz) ☒ 2 Channels for 40MHz bandwidth (5755MHz ~ 5795MHz) ☒ 1 Channels for 80MHz bandwidth (5775MHz)
Modulation Type	: ☒ 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) ☒ 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM) ☒ 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)
Ant type	FPC Antenna
Ant Gain	Gain: 2.25dBi for 2.4G; Wi-Fi 5.2G: 2.03 dBi; Wi-Fi 5.3G: 1.83 dBi; Wi-Fi 5.6G: 1.96 dBi Wi-Fi 5.8G: 2.19 dBi Manufacturer: SHENZHEN HANYANG ANTENNA DESIGN CO.LTD.

The module can be used for mobile or portable applications with a **maximum 2.25 dBi antenna**.

The host manufacturer installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation. The host manufacturer has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as shown in this manual.

2.4 Limited module procedures

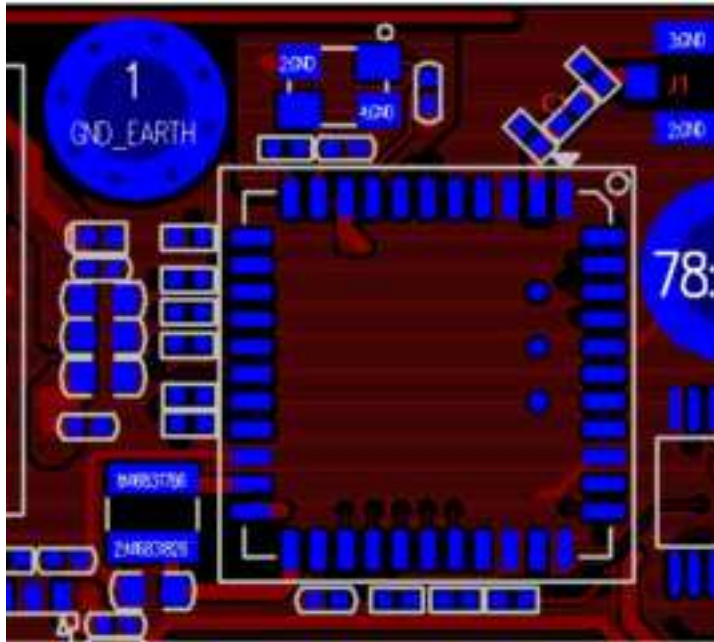
Not applicable. The module is a Single module and complies with the requirement of FCC Part 15.212.

2.5 Trace antenna designs

You can see antenna size is 36.2mm*14.6mm* From below Specification.



Please refer to the chart below for PCB size of RF line terminal.



Scrape a GND off the side of the J1,connect the FPC antenna to the PCB at the position of the J1 connector.

[The line between the FPC antenna and the WiFi module] must be 50 ohm.

C1 is 10pF Capacitors.

2.6 RF exposure considerations

The device can be used in portable exposure condition without restriction and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

2.7 Antennas

This module has been approved to operate with the antenna types listed below, with the maximum permissible gain indicated. The module requires professional installation, and the antenna type cannot be changed. The gain cannot exceed 2.25dBi.

Frequency band	Antenna Type	Model Number	Max Gain
2400-2500MHz	FPC antenna	N1911	2.25(dBi)
5150~5250MHz	FPC antenna	N1911	2.03(dBi)
5250~5350MHz	FPC antenna	N1911	1.83(dBi)
5470~5725MHz	FPC antenna	N1911	1.96(dBi)
5725~5850MHz	FPC antenna	N1911	2.19(dBi)

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.

As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

2.8 Label and compliance information

Host product manufacturers need to provide a physical or e-label stating

"Contains **FCC ID: VYVBW3456-44B1** With their finished product.

2.9 Information on test modes and additional testing requirements

Operation Mode	:	☒ BT BDR ☒ BT EDR
Operation Frequency	:	2402~2480MHz
Number of Channel	:	79 Channels
Modulation Type	:	GFSK, $\pi/4$ -DQPSK, 8-DPSK
Operation Mode	:	☒ BT BLE
Support Rate	:	☒ 1Mbps ☐ 2Mbps
Operation Frequency	:	2402~2480MHz
Number of Channel	:	40 Channels
Operation Mode	:	☒ 802.11b ☒ 802.11g ☒ 802.11n(HT20) ☐ 802.11n(HT40)
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Number of Channel	:	11 Channel for 20MHz bandwidth (2412~2462MHz)
Modulation Type	:	☒ 802.11b: DSSS (CCK, DQPSK, DBPSK) ☒ 802.11g: OFDM (BPSK, QPSK, 16QAM, 64QAM) ☒ 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM)
Operation Mode	:	☒ a ☒ n(HT20) ☒ n(HT40) ☒ ac(VHT20)

		☒ ac(VHT40) ☒ ac(VHT80)
Device Type	:	☒ Client
TPC Function	:	☒ Without TPC
DFS Type	:	☒ Slave without radar detection
Operation Frequency	:	☒ Wi-Fi 5.2G: 5150~5250MHz ☒ Wi-Fi 5.3G: 5250~5350MHz ☒ Wi-Fi 5.6G: 5470~5725MHz ☒ Wi-Fi 5.8G: 5725~5850MHz
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Modulation Type	:	☒ 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) ☒ 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM) ☒ 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)
Ant type		FPC Antenna
Ant Gain		Gain: 2.25dBi for 2.4G; Wi-Fi 5.2G: 2.03 dBi; Wi-Fi 5.3G: 1.83 dBi; Wi-Fi 5.6G: 1.96 dBi Wi-Fi 5.8G: 2.19 dBi Manufacturer: SHENZHEN HANYANG ANTENNA DESIGN CO.LTD.

Host manufacturer must perform 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.

2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247 & 15.407&

15.207 & 15.209 & 15.205 and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

2.11 The user manual of the end product should include:

- a) Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.
- b) The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons.
- c) This device complies with part 15 of the FCC Rules. Operation is subject 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.
- d) This device is restricted to indoor use.
- e) The antenna(s) used for this transmitter must not transmit simultaneously with any other antenna or transmitter.