

AW65P1-50B1

IEEE 802.11a/b/g/n/ac/ax 2T2R+Bluetooth 5.2 Combo Module



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1. Device Overview

1.1 Descriptions

The AW65P1-50B1 is a highly integrated module that supports 2T2R 802.11 a/b/g/n/ac/ax with Wireless LAN (WLAN) PCIe 2.1 interface controller and Bluetooth 5.2 HS-UART interface controller. The max PHY data rate can reach up to 1201Mbps when operating at 80MHz bandwidth. The Bluetooth modem supports BDR, EDR2/EDR3 modulations, and LE1M, LE2M, LE2S and LE8S BLE rates. The AW65P1-50B1 MAC supports 802.11e for multimedia applications, 802.11i and WAPI for security. The AW65P1-50B1 provides a complete solution for a high-performance integrated wireless and Bluetooth device. It provides advanced wireless performance for 4k/8k video scenarios such as IPTV STB, smart TV, smart speaker, tablet and other consumer products. It is also applied to emerging applications like AR/VR, service robots, etc.

1.2 Features

1.2.1 General Features

- 32bit RISC-V MCU for Wi-Fi protocols and host offload
- 32bit RISC-V MCU for Bluetooth controller
- Supports 3.3V power supply
- PCIe device interface compliant with PCIe 2.1 specification
- High speed UART interface with hardware flow control
- Wi-Fi and Bluetooth co-existence
- Can shared Bluetooth antenna with WLAN 2.4GHz
- LGA package
- Can be configured with 2 or 3 antennas

1.2.2 Wi-Fi Key Features

- IEEE 802.11a/b/g/n/ac/ax compatible WLAN
- Supports two spatial streams 2T2R MIMO
- Supports 2.4GHz and 5GHz
- Supports 20/40/80MHz bandwidth and modulation up to 1024-QAM
- Supports MU-MIMO RX
- Supports OFDMA RX and TB OFDMA TX
- Supports SU/MU RX Beamformee
- Supports STBC and LDPC
- Supports DFS

- Supports Wake-on-WLAN with programmable magic packet
- Security features:
 - Supports WEP-40/WEP-104, AES/TKIP/CCMP/GCMP
 - Supports WPA/WPA2/WPA3 personal, WPA2/WPA3 enterprise
 - Supports WPS2.0
 - Supports WAPI

1.2.3 Bluetooth Key Features

- Supports Bluetooth v5.2 with BLE audio
- Supports dual mode BDR/EDR and BLE
- Supports LE 1Mbps, LE 2Mbps, and LE coded for Long Range
- Supports Bluetooth Class 1 or Class 2 TX output power
- Supports dedicated Bluetooth antenna, or shared Bluetooth antenna with WLAN 2.4GHz
- Supports Bluetooth/Wi-Fi coexistence
- Supports LE privacy, DPLE, and LE secure connection
- Supports SCO/eSCO and A2DP
- Supports LE isochronous channels
- Supports HS-UART and PCM interfaces
- Backward-compatible with previous Bluetooth standards

1.3 Functional Block Diagram

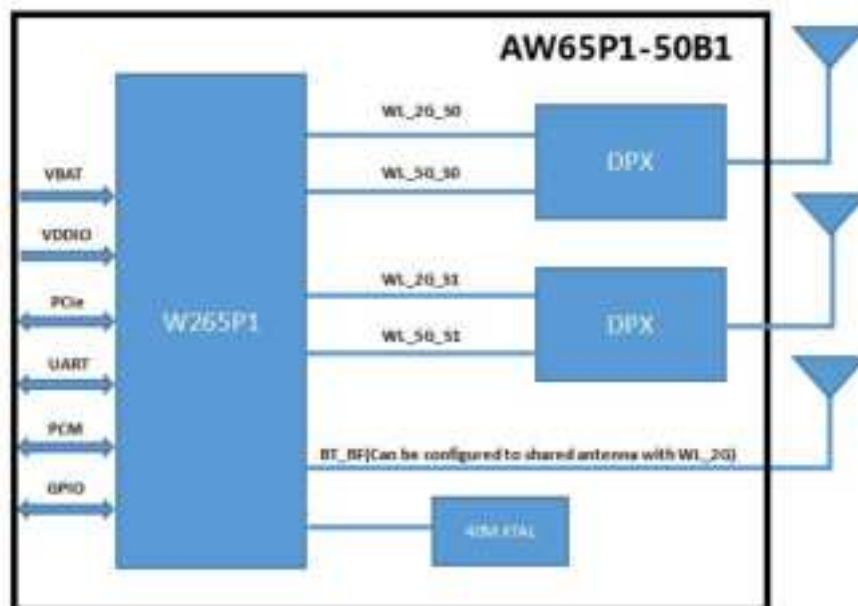


Figure 1. Block Diagram of AW65P1-50B1

2. Pin Configuration and Functions

2.1 Module Pin Diagram

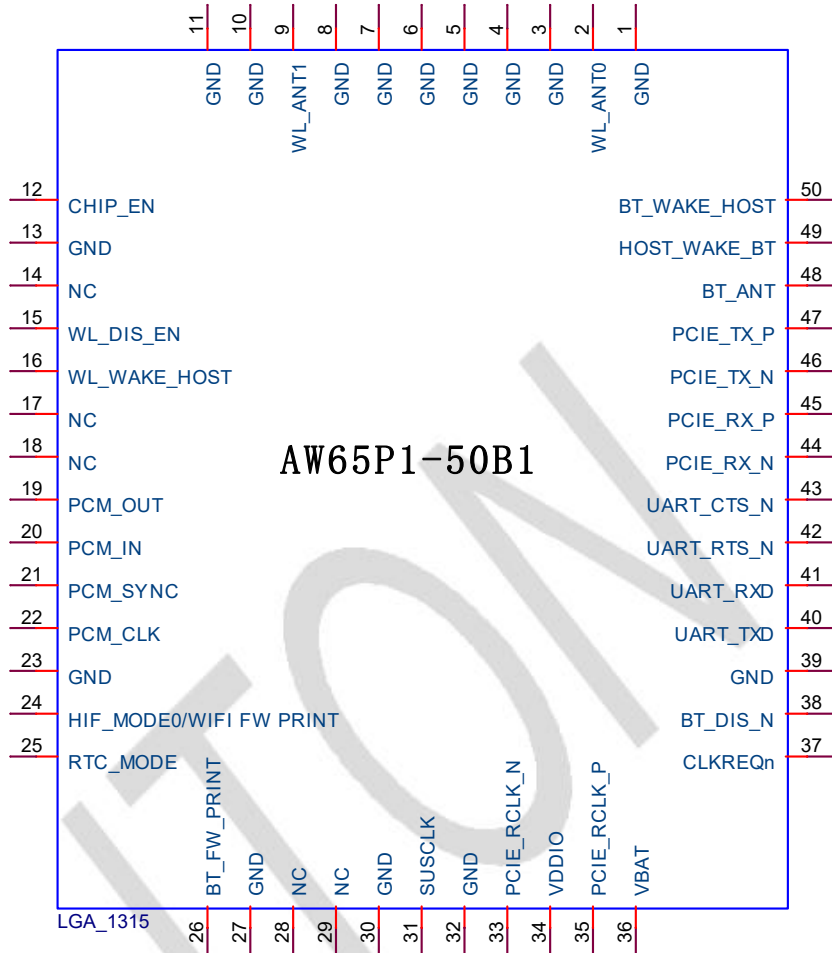


Figure 2.Pin Diagram of AW65P1-50B1

2.2 Pin Functions

Pin	Name	Description
1	GND	Ground
2	WL_ANT0	Status 1:RF input/output of path WF0 WLAN Status 2:RF input/output of path WF0 WLAN and BT PS:Status 1 and Status 2 can be configured throught FW.
3	GND	Ground
4	GND	Ground
5	GND	Ground

6	GND	Ground
7	GND	Ground
8	GND	Ground
9	WL_ANT1	RF input/output of path WF1 WLAN
10	GND	Ground
11	GND	Ground
12	CHIP_EN	Chip Enable/Disable Pin
13	GND	Ground
14	NC	No connect, keep floating
15	WL_DIS_EN	WLAN Chip Enable,Low asserting reset for WLAN core.
16	WL_WAKE_HOST	WLAN wake up the Host
17	NC	No connect, keep floating
18	NC	No connect, keep floating
19	PCM_OUT	Bluetooth PCM output
20	PCM_IN	Bluetooth PCM input
21	PCM_SYNC	Bluetooth PCM sync
22	PCM_CLK	Bluetooth PCM clock
23	GND	Ground
24	HIF_MODE0/WIFI FW PRINT	Default Low.No connect, keep floating.
25	RTC_MODE	CHIP Interface select for ext rtc/inner rtc, 0: ext; 1,inner Default High.
26	BT_FW_PRINT	External Grant,default High.No connect, keep floating.
27	GND	Ground
28	NC	No connect, keep floating
29	NC	No connect, keep floating
30	GND	Ground
31	SUSCLK	32K Chip RTC clock input.
32	GND	Ground
33	PCIE_RCLK_N	PCI Express Differential Reference Clock-
34	VDDIO	1.8V power supply
35	PCIE_RCLK_P	PCI Express Differential Reference Clock+

36	VBAT	3.3V power supply
37	CLKREQn	PCIe clock request signal
38	BT_DIS_N	Bluetooth Chip Enable, Low asserting reset for Bluetooth core.
39	GND	Ground
40	UART_TXD	Bluetooth High-Speed UART Data Out
41	UART_RXD	Bluetooth High-Speed UART Data In
42	UART_RTS_N	Bluetooth High-Speed UART RTS
43	UART_CTS_N	Bluetooth High-Speed UART CTS
44	PCIE_RX_N	PCIe differential pair RX data signal Negative
45	PCIE_RX_P	PCIe differential pair RX data signal Positive
46	PCIE_TX_N	PCIe differential pair TX data signal Negative
47	PCIE_TX_P	PCIe differential pair TX data signal Positive
48	BT_ANT	RF input/output port for BT PS: If configured as 3 antennas, need to connect this Pin. Otherwise, keep floating.
49	HOST_WAKE_BT	Host wake up BT
50	BT_WAKE_HOST	BT wake up Host

3. Specifications

3.1 General Characteristics

Category	Descriptions
Dimension	L*W*H :13.0mm (±0.2mm)*15.0mm (±0.2mm)*2.4mm (±0.2mm)
Chip-set	W265P1
Standard	IEEE 802.11a/b/g/n/ac/ax+BT 5.2
Modulation Type	CCK, OFDM (16 QAM/64 QAM/256 QAM/1024 QAM),OFDMA
Frequency Band	2400~2500MHz,4900-5845MHz
Interface	WLAN: PCIe, Bluetooth: UART
Data Security	WEP-40,WEP-104,AES/TKIP/CCMP/GCMP,WPA/WPA2/WPA3
Transmit Power(Conducted)	2.4G: 11b 1M:21dBm 11b 11M:21dBm 11g 6M:20dBm 11g 54M:18dBm 11n HT20 MCS0:20dBm 11n HT20 MCS7:17dBm 11n HT40 MCS0:19dBm 11n HT40 MCS7:16dBm 11ax HE20 MCS0:19dBm 11ax HE20 MCS11:13dBm 11ax HE40 MCS0:19dBm 11ax HE40 MCS11:13dBm 5G: 11a 6M:16dBm 11a 54M:13dBm 11n HT20 MCS0:15dBm 11n HT20 MCS7:13dBm 11n HT40 MCS0:15dBm 11n HT40 MCS7:12dBm 11ac VHT20 MCS0:14dBm 11ac VHT20 MCS8:12dBm 11ac VHT40 MCS0:14dBm 11ac VHT40 MCS9:12dBm 11ac VHT80 MCS0:14dBm 11ac VHT80 MCS9:11dBm

	11ax HE20 MCS0:14dBm 11ax HE20 MCS11:10dBm 11ax HE40 MCS0:14dBm 11ax HE40 MCS11:10dBm 11ax HE80 MCS0:14dBm 11ax HE80 MCS11:10dBm
Rx Sensitivity	2.4G: 11b 11M:-88@8% PER 11g 54M: -74@10% PER 11n HT20 MCS7: -71@10% PER 11n HT40 MCS7: -69@10% PER 11ax HE40 MCS11: -59@10% PER 5G: 11a 54M: -74@10% PER 11n HT20 MCS7: -71@10% PER 11n HT40 MCS7: -68@10% PER 11ac VTH80 MCS9: -58@10% PER 11ax HE40 MCS11: -58@10% PER 11ax HE80 MCS11: -56@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 144.4Mbps 802.11n HT40:up to 300Mbps 802.11ac VHT80:up to 866.7Mbps 802.11ax HE20:up to 286.8Mbps 802.11ax HE40:up to 573.6Mbps 802.11ax HE80:up to 1201Mbps
Frequency Error	2.4GHz:<±25 ppm(11b),<±20 ppm(11g/n);5GHz:<±20 ppm
Ambient Temperature	0℃~70℃
Storage Temperature	-40℃~125℃
Antenna	External antenna
Operating System	Android, Linux
Operating Voltage	VBAT:3.3V VDDIO:1.8V

3.2 RF Characteristics

All measurements are made under nominal supply voltage, room temperature and conducted conditions at

each 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/ax 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	-	-	-82	dBm
	MCS1.		-	-	-79	dBm
	MCS2		-	-	-77	dBm
	MCS3.		-	-	-74	dBm
	MCS4.		-	-	-70	dBm
	MCS5.		-	-	-66	dBm
	MCS6.		-	-	-65	dBm
	MCS7.		-	-	-64	dBm
802.11n (HT40)	MCS0.	PER<10%, Packet size= 4,096bytes	-	-	-79	dBm
	MCS1.		-	-	-77	dBm
	MCS2		-	-	-74	dBm
	MCS3.		-	-	-71	dBm
	MCS4.		-	-	-67	dBm
	MCS5.		-	-	-63	dBm
	MCS6.		-	-	-62	dBm
	MCS7.		-	-	-61	dBm

802.11ax (HE20)	MCS0.	PER<10%, Packet size= 4,096bytes	-	-	-82	dBm
	MCS1.		-	-	-79	dBm
	MCS2		-	-	-77	dBm
	MCS3.		-	-	-74	dBm
	MCS4.		-	-	-70	dBm
	MCS5.		-	-	-66	dBm
	MCS6.		-	-	-65	dBm
	MCS7.		-	-	-64	dBm
	MCS8.		-	-	-59	dBm
	MCS9.		-	-	-57	dBm
	MCS10.		-	-	-54	dBm
	MCS11.		-	-	-52	dBm
802.11ax (HE40)	MCS0.	PER<10%, Packet size= 4,096bytes	-	-	-79	dBm
	MCS1.		-	-	-76	dBm
	MCS2		-	-	-74	dBm
	MCS3.		-	-	-71	dBm
	MCS4.		-	-	-67	dBm
	MCS5.		-	-	-63	dBm
	MCS6.		-	-	-62	dBm
	MCS7.		-	-	-61	dBm
	MCS8.		-	-	-56	dBm
	MCS9.		-	-	-54	dBm
	MCS10.		-	-	-51	dBm
	MCS11.		-	-	-49	dBm
Maximum input level						
802.11b	FER<8%		-10	-	-	dBm
802.11g	FER<10%		-20	-	-	dBm
802.11n	FER<10%		-30			dBm
802.11ax	FER<10%		-20			dBm

Parameter	Conditions		Min.	Nom.	Max.	Unit
Receive input frequency						
5GHz	802.11a/n/ac/ax mode		4900	-	5845	MHz
Receiver sensitivity						
802.11a	6Mbps	FER<10%,	-	-	-82	dBm
	9Mbps	Packet size=	-	-	-81	dBm

	12Mbps	1,024bytes	-	-	-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	-	-	-82	dBm
	9Mbps		-	-	-79	dBm
	12Mbps		-	-	-77	dBm
	18Mbps		-	-	-74	dBm
	24Mbps		-	-	-70	dBm
	36Mbps		-	-	-66	dBm
	48Mbps		-	-	-65	dBm
	54Mbps		-	-	-64	dBm
802.11n (HT40)	MCS0.	PER<10%, Packet size= 4,096bytes	-	-	-79	dBm
	MCS1.		-	-	-77	dBm
	MCS2		-	-	-74	dBm
	MCS3.		-	-	-71	dBm
	MCS4.		-	-	-67	dBm
	MCS5.		-	-	-63	dBm
	MCS6.		-	-	-62	dBm
	MCS7.		-	-	-61	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
802.11ax (HE80)	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
	MCS10.		-	-	-48	dBm
	MCS11.		-	-	-46	dBm
Maximum input level						
802.11a	FER<10%		-30	-	-	dBm
802.11n	FER<10%		-30	-	-	dBm
802.11ac	FER<10%		-30	-	-	dBm
802.11ax	FER<10%		-30	-	-	dBm

3.2.2 Transmitter RF Specifications

Parameter	Condition	Min.	Nom.	Max.	Unit.
Receive input frequency					
802.11b/g/n/ax	2.4GHz	2400	-	2500	MHz
Transmit power(Conducted)					
802.11b	1Mbps	19	21	23	dBm
	11Mbps	19	21	23	dBm
802.11g	6Mbps	18	20	22	dBm
	54Mbps	16	18	20	dBm
802.11n	HT20, MCS0	18	20	22	dBm
	HT20, MCS7	15	17	19	dBm
	HT40, MCS0	17	19	21	dBm
	HT40, MCS7	14	16	18	dBm
802.11ax	HE20,MCS0	17	19	21	dBm
	HE20,MCS11	11	13	15	dBm
	HE40,MCS0	17	19	21	dBm
	HE40,MCS11	11	13	15	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

	$f_c+55\text{MHz}$				
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
802.11ax (HE40)	$f_c\pm 19.5\text{MHz}$	-	-	0	dBr
	$f_c\pm 20.5\text{MHz}$	-	-	-20	dBr
	$f_c\pm 40\text{MHz}$	-	-	-28	dBr
	$f_c\pm 60\text{MHz}$	-	-	-40	dBr
Center frequency tolerance					
802.11b		-25	-	+25	pmm
802.11g/n/ax		-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
802.11ax	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
	MCS10.	-	-	-35	dB
	MCS11.	-	-	-35	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/ax	5GHz	4900	-	5845	MHz
Transmit power(Conducted)					
802.11a	6Mbps	14	16	18	dBm
	54Mbps	11	13	15	dBm
802.11n	HT20, MCS0	13	15	17	dBm
	HT20, MCS7	11	13	15	dBm
	HT40, MCS0	13	15	17	dBm
	HT40, MCS7	10	12	14	dBm
802.11ac	VHT20,MCS0	12	14	16	dBm
	VHT20,MCS8	10	12	14	dBm
	VHT40,MCS0	12	14	16	dBm
	VHT40,MCS9	10	12	14	dBm
	VHT80,MCS0	12	14	16	dBm

	VHT80,MCS9	9	11	13	dBm
802.11ax	HE20,MCS0	12	14	16	dBm
	HE20,MCS11	8	10	12	dBm
	HE40,MCS0	12	14	16	dBm
	HE40,MCS11	8	10	12	dBm
	HE80,MCS0	12	14	16	dBm
	HE80,MCS11	8	10	12	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
802.11ax (HE80)	$f_c \pm 39.5\text{MHz}$	-	-	0	dBr
	$f_c \pm 40.5\text{MHz}$	-	-	-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/ax		-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
802.11ax	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
	MCS10.	-	-	-35	dB
	MCS11.	-	-	-35	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	1 Mbps	-	-88	-	dBm
	2 Mbps	-	-85	-	dBm
	3 Mbps	-	-85	-	dBm
	LE1M	-	-92	-	dBm
	LE2M	-	-92	-	dBm
Initial carrier frequency offset		-40	5	40	KHz
Output power(Conducted)	1 Mbps	9	12	15	dBm
	2 Mbps	6	9	12	dBm
	3 Mbps	6	9	12	dBm
	LE 1M	9	12	15	dBm
	LE 2M	9	12	15	dBm

4. Application and Implementation

4.1 Application Diagram

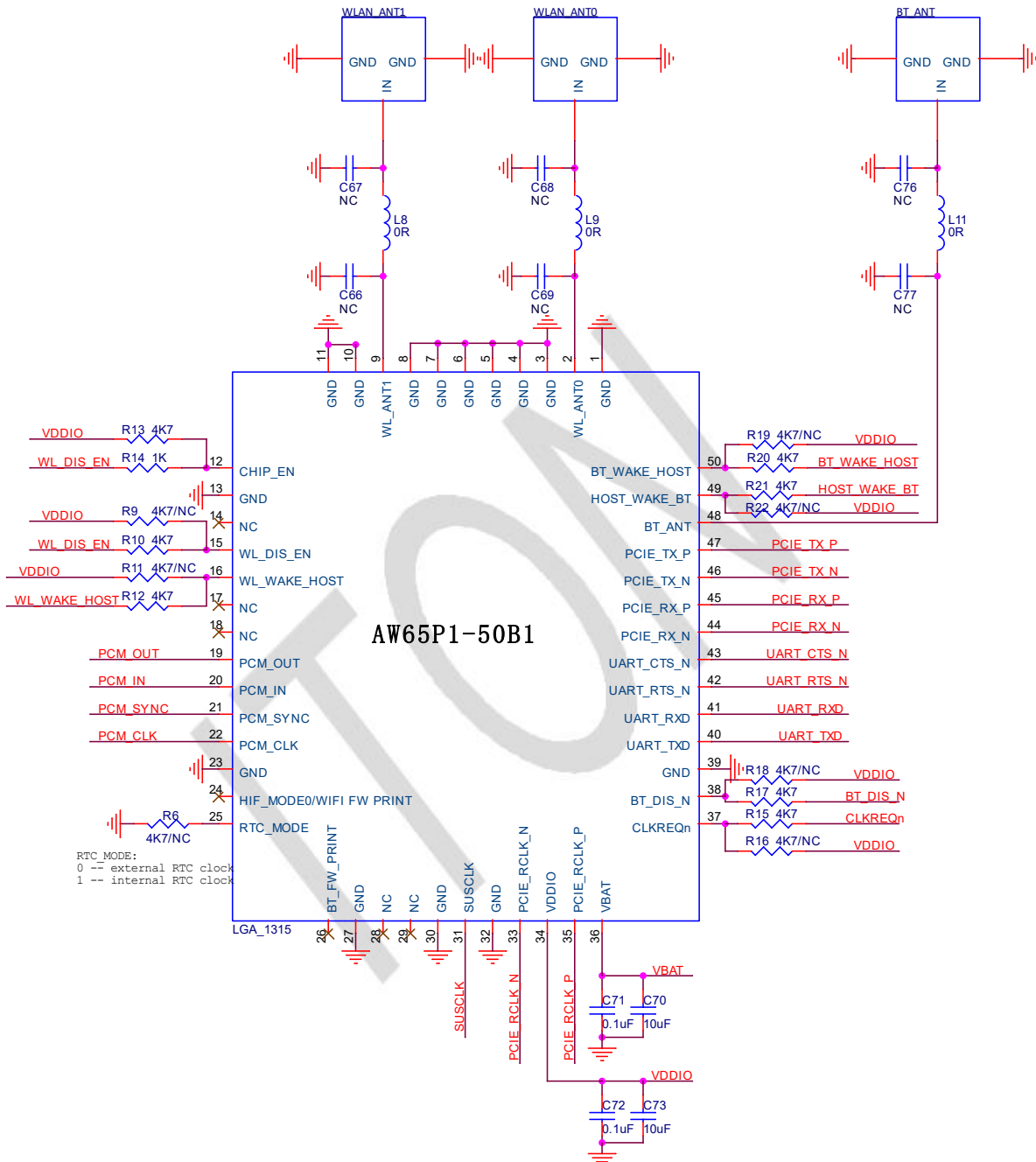


Figure 3. Application Schematic Diagram of AW65P1-50B1

5. Mechanical and Package

5.1 Mechanical Size

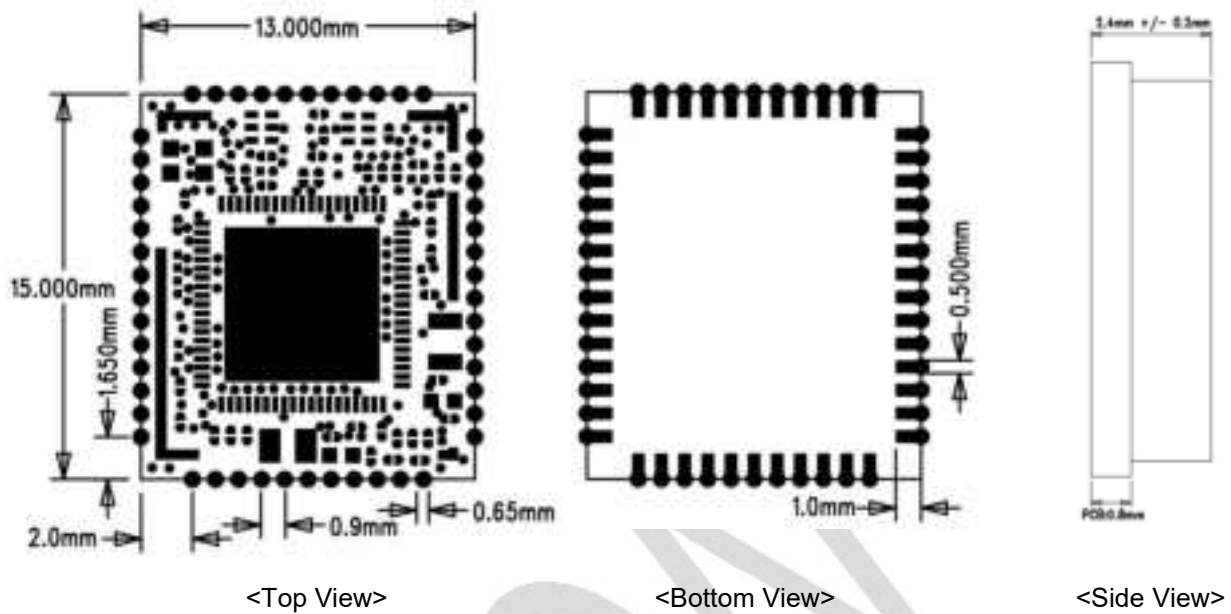


Figure 4. Mechanical Size of AW65P1-50B1

5.2 Recommended Land Pattern

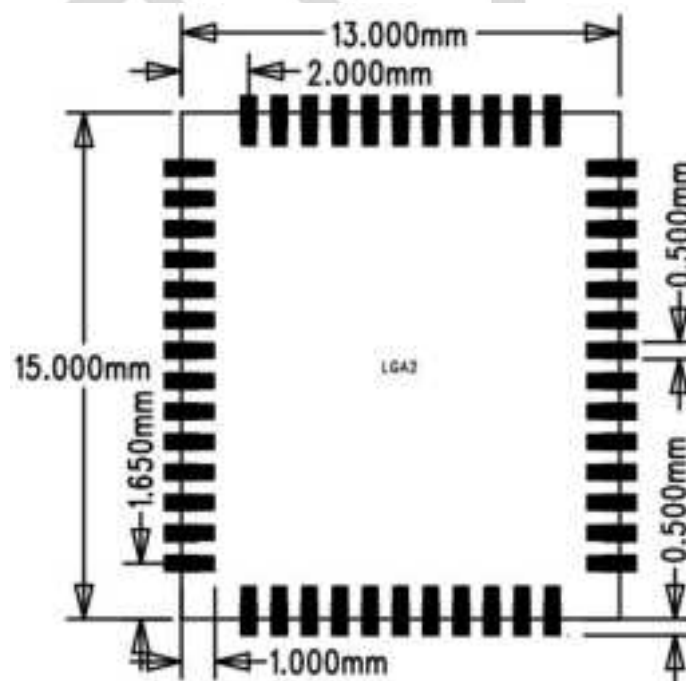


Figure5.Recommended Land Pattern of AW65P1-50B1

5.3 Package Information

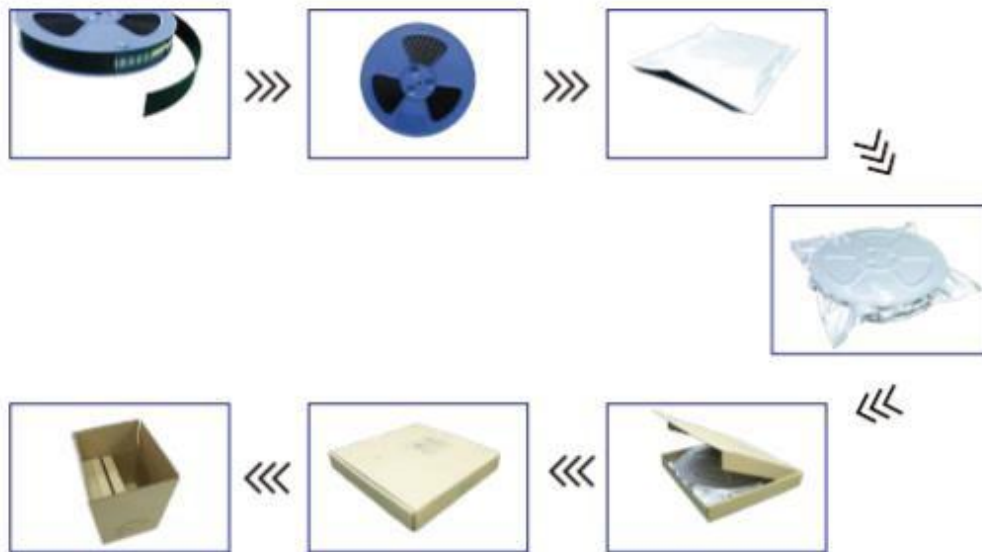


Figure 6. Brief Packaging Process of AW65P1-50B1 Modules

6. Thermal Reflow

Referred to IPC/JEDEC standard.

Peak temperature: <250°C

Number of times: ≤2

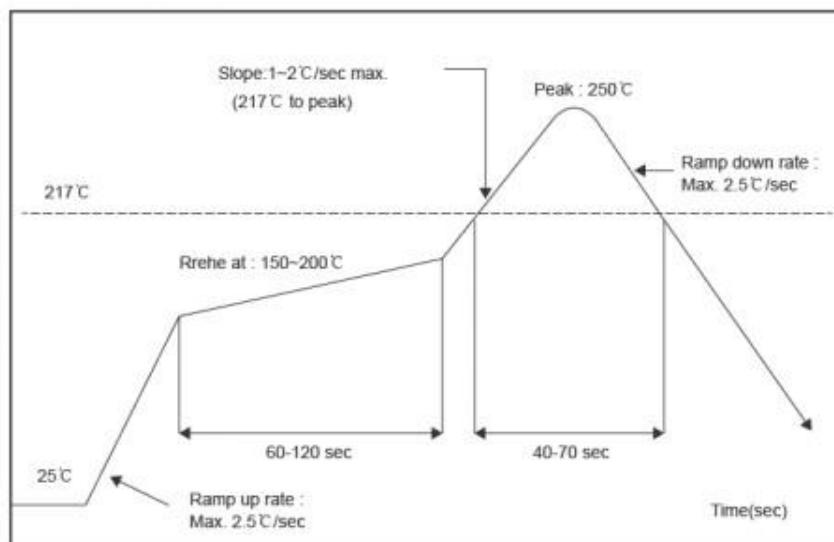


Figure 7. Recommended Reflow for Lead Free Solder

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

7. Ordering Information

Part NO.	Working Voltage	ANT	Shielding Cover	Remark
AW65P1-50B1	VBAT:3.3V VDDIO:1.8V	External antenna	Included	

8. Revision History

Version	Change Content	Reviser	Date
V0.1	Draft Version	Phil Ye	2023.02.10
V0.2	Modify Descriptions	Phil Ye	2023.02.21
V0.3	Update Module Pin Functions Update RF Parameters Update Ordering Information	Phil Ye	2023.06.16

FCC

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: VYVAW65P1-50B1".

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 mobile 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 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 & 15.207 & 15.209 & 15.205; 47 CFR Part 15E

2.3 Specific operational use conditions

BDR+EDR

Operation Frequency	:	2402MHz to 2480MHz
Number of Channel	:	79
Modulation Type	:	GFSK, $\pi/4$ DQPSK, 8DPSK
Antenna Type	:	Dipole Antenna
Antenna Gain(Peak)	:	2.53dBi

BLE

Operation Frequency	:	2402MHz to 2480MHz
Number of Channel	:	40
Modulation Type	:	GFSK
Antenna Type	:	Dipole Antenna
Antenna Gain(Peak)	:	2.53dBi

WIFI 2.4G

Operation Frequency	:	802.11b/g/n(HT20)/ax(HEW20): 2412MHz to 2462MHz; 802.11n(HT40)/ax(HEW40): 2422MHz to 2452MHz
Number of Channel	:	802.11b/g/n(HT20)/ax(HEW20): 11 Channels; 802.11n(HT40)/ax(HEW40): 7 Channels
Modulation Type	:	802.11b: DSSS(CCK, DQPSK, DBPSK); 802.11g: OFDM(BPSK, QPSK, 16QAM, 64QAM); 802.11n(HT20 and HT40): OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ax(HEW20 and HEW4): OFDMA(BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
Antenna Type	:	ANT1: Dipole Antenna ANT2: Dipole Antenna
Antenna Gain(Peak)	:	ANT1: 2.53 dBi ANT2: 2.53 dBi
Directional antenna gain	:	5.54 dBi

WIFI 5G

Operation Frequency	: 802.11a/n(HT20)/ac(VHT20)/ax(HEW20): U-NII Band 1: 5180MHz to 5240MHz; U-NII Band 2A: 5260MHz to 5320MHz; U-NII Band 2C: 5500MHz to 5700MHz; U-NII Band 3: 5745MHz to 5825MHz; 802.11n(HT40)/ac(VHT40)/ax(HEW40): U-NII Band 1: 5190MHz to 5230MHz; U-NII Band 2A: 5270MHz to 5310MHz; U-NII Band 2C: 5510MHz to 5670MHz; U-NII Band 3: 5755MHz to 5795MHz; 802.11ac(VHT80)/ax(HEW80): U-NII Band 1: 5210MHz; U-NII Band 2A: 5290MHz; U-NII Band 2C: 5530MHz to 5610MHz; U-NII Band 3: 5775MHz
Number of Channel	: 802.11a/n(HT20)/ac(HT20)/ax(HEW20): U-NII Band 1: 4; U-NII Band 2A: 4; U-NII Band 2C: 11; U-NII Band 3: 5; 802.11n(HT40)/ac(HT40)/ax(HEW40): U-NII Band 1: 2; U-NII Band 2A: 2; U-NII Band 2C: 5; U-NII Band 3: 2; 802.11ac(HT80)/ax(HEW80): U-NII Band 1: 1; U-NII Band 2A: 1; U-NII Band 2C: 2; U-NII Band 3: 1
Modulation Type	: 802.11a: OFDM(BPSK, QPSK, 16QAM, 64QAM); 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM); 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM);

		802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
Antenna Type	:	ANT1: Dipole Antenna ANT2: Dipole Antenna
Antenna Gain(Peak)	:	WiFi 5.2G ANT 1: 1.87 dBi WiFi 5.2G ANT 2: 1.87 dBi WiFi 5.3G ANT 1: 2.11 dBi WiFi 5.3G ANT 2: 2.11 dBi WiFi 5.6G ANT 1: 2.93 dBi WiFi 5.6G ANT 2: 2.93 dBi WiFi 5.8G ANT 1: 3.16 dBi WiFi 5.8G ANT 2: 3.16 dBi
Directional antenna gain	:	WiFi 5.2G: 4.88 dBi WiFi 5.3G: 5.12 dBi WiFi 5.6G: 5.94 dBi WiFi 5.8G: 6.17 dBi

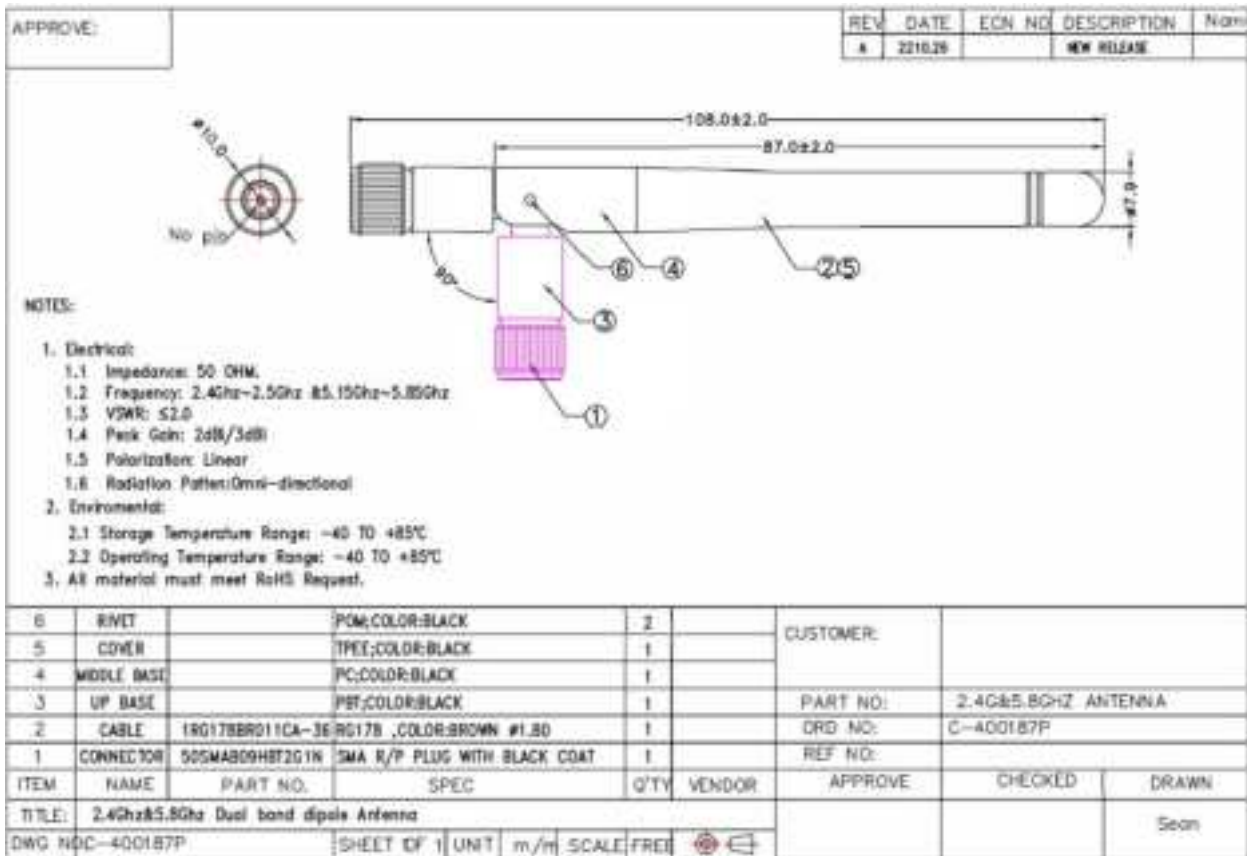
The module can be used for mobile applications with a **maximum 2.53 dBi antenna for 2.4G, maximum 1.87 dBi antenna for WiFi 5.2G, maximum 2.11 dBi antenna for WiFi 5.3G, maximum 2.93 dBi antenna for WiFi 5.6G, maximum 3.16 dBi antenna for WiFi 5.8G**. The host manufacturer installing this module into 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

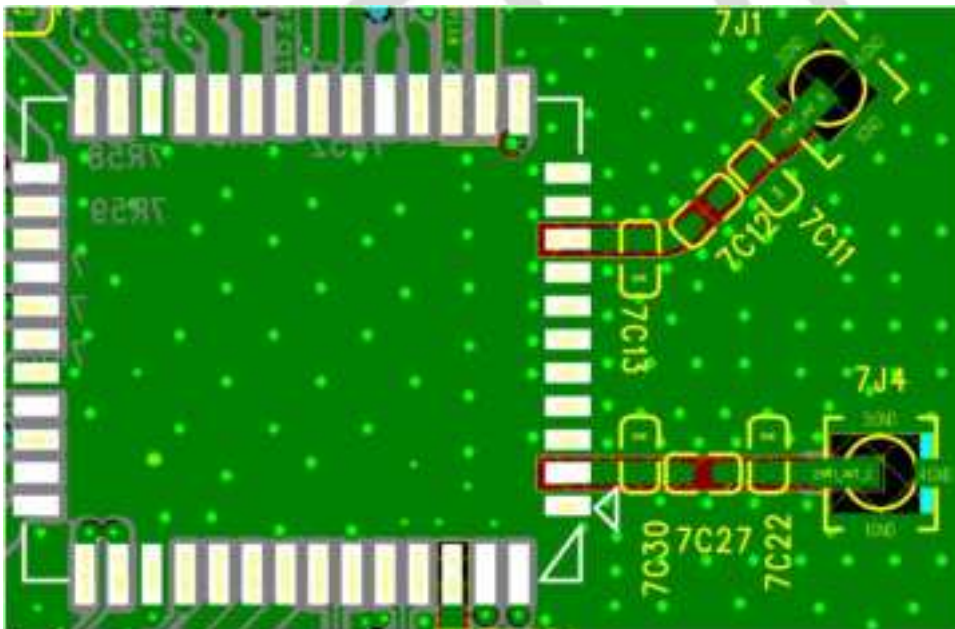
Not applicable. The module is a Single module and complies with the requirement of FCC Part 15.212.

2.5 Trace antenna designs

You can see antenna size is 108.2mm*7.9mm* 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 Dipole antenna and the WiFi module] must be 50 ohm.

7C12 and 7C27 are 10pF Capacitors.

7C13 is NC.

7C11 is NC.

7C30 is NC.

7C22 is NC.

2.6 RF exposure considerations

The device can be used in mobile 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 with 2.4G, 1.87 dBi with WiFi 5.2G, 2.11 dBi with WiFi 5.3G, 2.93 dBi with for WiFi 5.6G, 3.16 dBi with WiFi 5.8G..

Frequency band	Antenna Type	Model Number	Max Gain
2400-2500MHz	Dipole Antenna	2.4Ghz&5.8Ghz Dual band dipole Antenna	2.53(dBi)
5100-5250MHz	Dipole Antenna	2.4Ghz&5.8Ghz Dual band dipole Antenna	1.87(dBi)
5250-5350MHz	Dipole Antenna	2.4Ghz&5.8Ghz Dual band dipole Antenna	2.11(dBi)
5300-5750MHz	Dipole Antenna	2.4Ghz&5.8Ghz Dual band dipole Antenna	2.93(dBi)
5700-5850MHz	Dipole Antenna	2.4Ghz&5.8Ghz Dual band dipole Antenna	3.16(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:** VYVAW65P1-50B1 With their finished product.

2.9 Information on test modes and additional testing requirements

BDR+EDR

Operation Frequency	:	2402MHz to 2480MHz
Number of Channel	:	79
Modulation Type	:	GFSK, $\pi/4$ DQPSK, 8DPSK
Antenna Type	:	Dipole Antenna
Antenna Gain(Peak)	:	2.53dBi

BLE

Operation Frequency	:	2402MHz to 2480MHz
Number of Channel	:	40
Modulation Type	:	GFSK
Antenna Type	:	Dipole Antenna
Antenna Gain(Peak)	:	2.53dBi

WIFI 2.4G

Operation Frequency	:	802.11b/g/n(HT20)/ax(HEW20): 2412MHz to 2462MHz; 802.11n(HT40)/ax(HEW40): 2422MHz to 2452MHz
Number of Channel	:	802.11b/g/n(HT20)/ax(HEW20): 11 Channels; 802.11n(HT40)/ax(HEW40): 7 Channels
Modulation Type	:	802.11b: DSSS(CCK, DQPSK, DBPSK); 802.11g: OFDM(BPSK, QPSK, 16QAM, 64QAM);

		802.11n(HT20 and HT40): OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ax(HEW20 and HEW4): OFDMA(BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
Antenna Type	:	ANT1: Dipole Antenna ANT2: Dipole Antenna
Antenna Gain(Peak)	:	ANT1: 2.53 dBi ANT2: 2.53 dBi
Directional antenna gain	:	5.54 dBi

WIFI 5G

Operation Frequency	:	802.11a/n(HT20)/ac(VHT20)/ax(HEW20): U-NII Band 1: 5180MHz to 5240MHz; U-NII Band 2A: 5260MHz to 5320MHz; U-NII Band 2C: 5500MHz to 5700MHz; U-NII Band 3: 5745MHz to 5825MHz; 802.11n(HT40)/ac(VHT40)/ax(HEW40): U-NII Band 1: 5190MHz to 5230MHz; U-NII Band 2A: 5270MHz to 5310MHz; U-NII Band 2C: 5510MHz to 5670MHz; U-NII Band 3: 5755MHz to 5795MHz; 802.11ac(VHT80)/ax(HEW80): U-NII Band 1: 5210MHz; U-NII Band 2A: 5290MHz; U-NII Band 2C: 5530MHz to 5610MHz; U-NII Band 3: 5775MHz
Number of Channel	:	802.11a/n(HT20)/ac(HT20)/ax(HEW20): U-NII Band 1: 4; U-NII Band 2A: 4; U-NII Band 2C: 11; U-NII Band 3: 5; 802.11n(HT40)/ac(HT40)/ax(HEW40): U-NII Band 1: 2; U-NII Band 2A: 2; U-NII Band 2C: 5;

		U-NII Band 3: 2; 802.11ac(HT80)/ax(HEW80): U-NII Band 1: 1; U-NII Band 2A: 1; U-NII Band 2C: 2; U-NII Band 3: 1
Modulation Type	:	802.11a: OFDM(BPSK, QPSK, 16QAM, 64QAM); 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM); 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM); 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
Antenna Type	:	ANT1: Dipole Antenna ANT2: Dipole Antenna
Antenna Gain(Peak)	:	WiFi 5.2G ANT 1: 1.87 dBi WiFi 5.2G ANT 2: 1.87 dBi WiFi 5.3G ANT 1: 2.11 dBi WiFi 5.3G ANT 2: 2.11 dBi WiFi 5.6G ANT 1: 2.93 dBi WiFi 5.6G ANT 2: 2.93 dBi WiFi 5.8G ANT 1: 3.16 dBi WiFi 5.8G ANT 2: 3.16 dBi
Directional antenna gain	:	WiFi 5.2G: 4.88 dBi WiFi 5.3G: 5.12 dBi WiFi 5.6G: 5.94 dBi WiFi 5.8G: 6.17 dBi

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 & 15.207 & 15.209 & 15.205, 47 CFR Part 15E 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.

ITON