

保密等级：机密

SPECIFICATION

产品规格书

SKI.WB920TU.2 A23023

IEEE 802.11b/g/n/a/ac/ax 2T2R USB WiFi Module

Integrated BT 2.1+EDR/4.2/5.2

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REVISION HISTORY.

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1. Introduction（简介）

SKI.WB920TU.2 module is based on MediaTek MT7920TUN solution.

MT7920TUN is a highly integrated single chip which features a low power 2x2 11a/b/g/n/ac/ax dual-band Wi-Fi subsystem and a Bluetooth v5.2 subsystem, offering feature-rich wireless connectivity at high standards, and delivering reliable, cost-effective throughput from an extended distance.

MT7920TUN data rate up to 800Mbps with USB3.0. Optimized RF architecture and baseband algorithms provide superb performance and low power consumption. Intelligent MAC design deploys a high efficient offload engine, and hardware data processing accelerators which fully offloads Wi-Fi task of the host processor, MT7920TUN is designed to support standard based features in the areas of security, quality of service and international regulations, giving end users the greatest performance any time and in any circumstance. This documentation describes the engineering requirements specification.

SKI.WB920TU.2 模块基于联发科 MT7920TUN 方案。MT7920TUN 是一款高度集成的单芯片，符合 2x2 11a/b/g/n/ac/ax 标准，支持低功耗的双频 Wi-Fi 和蓝牙 v5.2 子系统，提供功能丰富的无线标准接口，以及可靠、高效的远距离吞吐量。

MT7920TUN 使用 USB3.0 高速接口，数据速率高达 800Mbps，优化后的射频架构和基带算法提供了卓越的性能，并且功耗很低。MAC 部署了一个高效的卸载引擎和硬件数据处理加速器，可完全卸载主机处理器的 Wi-Fi 任务。MT7920TUN 安全、优异的性能，并且符合国际法律法规标准，无论何时何地都为用户提供最好的应用体验。本文档描述了工程要求规范。

2. Features（特性）

Reserving System 接收制式	IEEE Std. 802.11a
	IEEE Std. 802.11b
	IEEE Std. 802.11g
	IEEE Std. 802.11n
	IEEE Std. 802.11ac
	IEEE Std. 802.11ax
	BT 2.1+EDR
	BT 4.2
	BT 5.2 with BLE (BT low energy)

Chip Solution 芯片方案	MT7920TUN
Band 波段	2.4GHz&5GHz
Dimensions 尺寸	25.6mm×23mm×2.4mm

型号	安装方式	支持标准	频段	天线接口	备注
SKI.WB920TU.2	SMD	IEEE 802.11a/b/g/n/ac/ax BT 2.1+EDR/4.2/5.2	2.4GHz/5GHz	IPEX*3	25.6mm×23mm× 2.4mm

3. Block Diagram (结构框图)

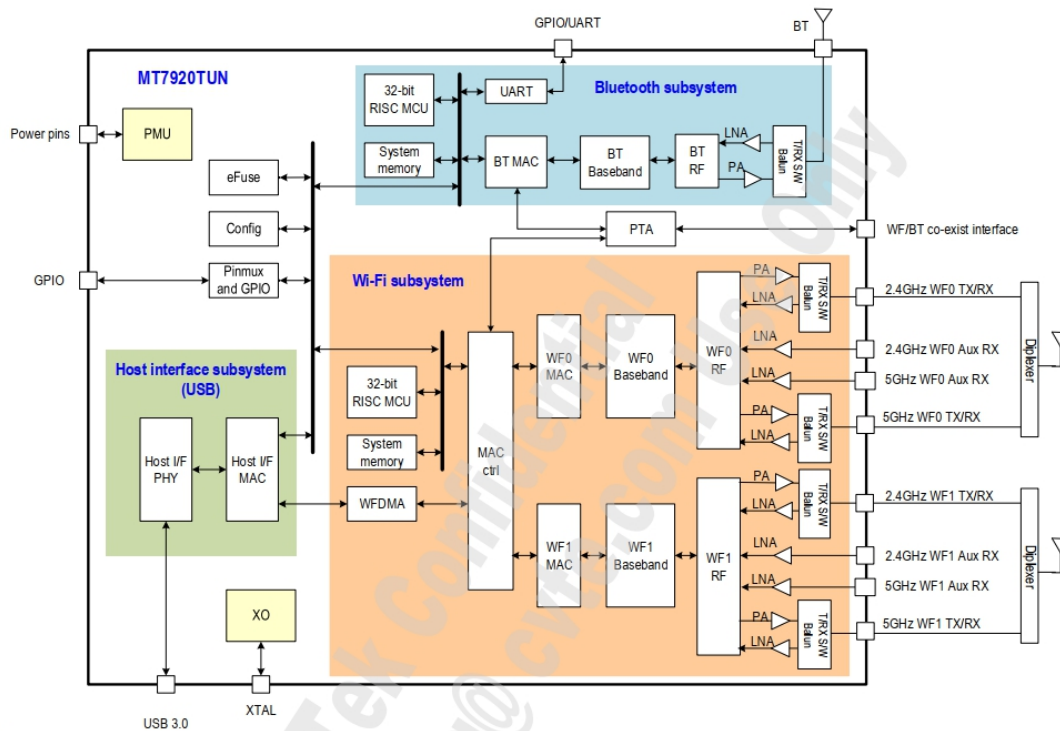
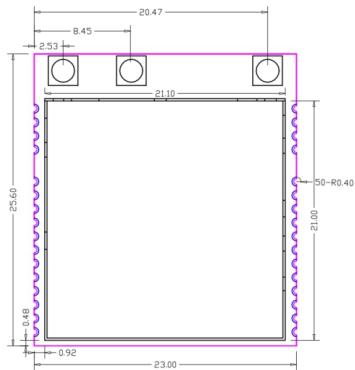


Figure 1 SKI.WB920TU.2 Block Diagram

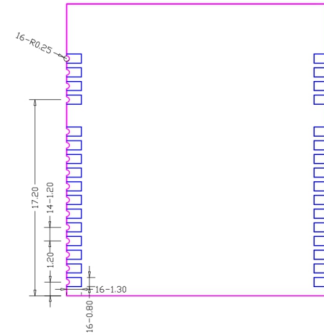
4. Package Outline and Mounting（外形及安装尺寸）



模组主视图



模组侧视图

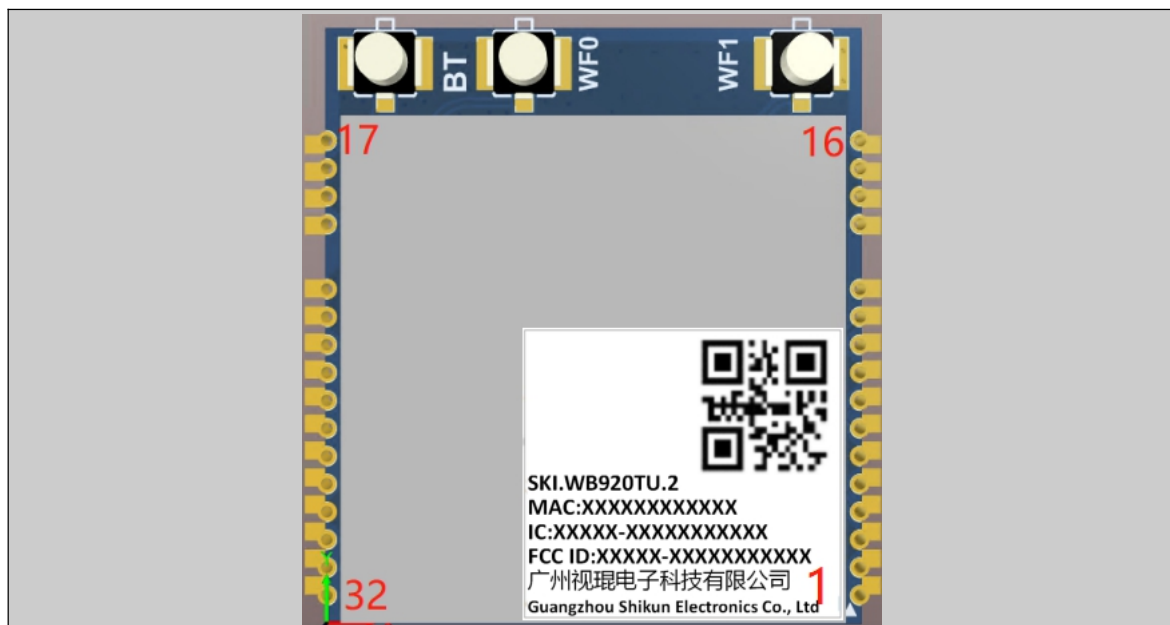


模组后视图

NOTE:

1. 板内顶层器件最高1.75mm，底层无器件；
2. 模组外形尺寸公差为 $\pm 0.15\text{mm}$ ，板厚以及未标注公差为 $\pm 0.1\text{mm}$ 。

5. Pin Definition（引脚定义）

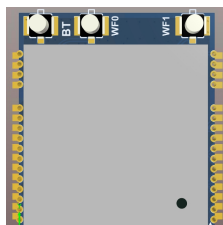


模组正视图

PIN	SYMBOL	DESCRIPTION
1	U3-TXN	USB3.0 TXN, 连接主平台 RXN
2	U3-TXP	USB3.0 TXP, 连接主平台 RXP
3	GND	Ground
4	U3-RXN	USB3.0 RXN, 连接主平台 TXN
5	U3-RXP	USB3.0 RXP, 连接主平台 TXP
6	GND	Ground
7	U2-DP	USB2.0 DP, 连接主平台 DP

8	U2-DM	USB2.0 DM, 连接主平台 DM
9	GND	Ground
10	WIFI_WAKE	WIFI 唤醒主机, 内部 10K 上拉, 低电平有效
11	BT_WAKE	BT 唤醒主机, 内部 10K 上拉, 低电平有效
12	GPIO3	LE Audio
13	NC	Not connect
14	GND	Ground
15	GND	Ground
16	WiFi1	Not connect(默认使用板载 ipex)
17	WiFi0	Not connect(默认使用板载 ipex)
18	GND	Ground
19	GND	Ground
20	BT0	Not connect(默认使用板载 ipex)
21	GND	Ground
22	GND	Ground
23	WGPI013_WL_FW_DB	Debug 引脚
24	WGPI08	PCM_IN
25	WGPI07	PCM_OUT
26	RST_N	复位引脚
27	3.3V	3.3V
28	VIO	3.3V
29	GND	GND 接地
30	WGPI06_PCM_SYNC	PCM_SYNC
31	WGPI011	WGPI011
32	WGPI010_PCM_CLK	PCM_CLK

6. Product Pictures (实物图片)

模组料号	正视图	背视图	备注
002.029.0000988			

丝印说明:

- (1) 红色方框内的字符为产品 PCB 型号;
- (2) 黄色方框内的字符为产品周期号;
- (3) 其他为非关键字符, 无须管控。

7. Key Materials (关键物料)

序号	关键件名称	型号	规格/材料	备注
1	集成电路	MT7920TUN	91-DRQFN	MTK
2	PCB	SKI.WB920TU.2	FR-4,4LAY	
3	晶体振荡器	40MHz, ± 10 ppm, 2016	40MHz	JWT,MDH,TXC,Murata
4	双工器	1608 Dual-band, dual-mode 2.4GHz/5GHz WLAN	2.4GHz/5GHz	Sunlord,ACX, TDK,PSA

8. General Requirements (一般要求)

No.	Feature	Description
1	Operation Voltage 工作电压范围	3.3V+/-0.3
2	Current Consumption 最大电流	900mA (预留 2A)
3	Ripple 纹波	≤ 120 mV
4	Operation Temperature 工作温度范围	-10°C to +70°C
5	Antenna Type 天线类型	External antenna
6	Interface	High Speed USB 3.0 Interface (兼容 High Speed USB 2.0 Interface)
7	Storage Temperature 存储温度	-40°C to +75°C

9. Electrical Characteristics (电气特性)

除非另有说明，电气规范试验都在下列条件下进行：

环境条件温度：25°C $\pm$ 5°C；

电源电压：模块输入电压 3.3V+/-0.3；

The Test for electrical specification was performed under the following condition unless otherwise specified:

Ambient condition Temperature :25°C $\pm$ 5°C；

Power supply voltages: 3.3V+/-0.3 input power at the Module;

9.1 IEEE 802.11b Section(2.4GHz)

Items	Contents				
Specification	IEEE802.11b				
Mode	CCK				
Channel	CH1 to CH13				
TX Characteristics	Min.	Typ.	Max.	Unit	Remark
1. Power Levels(Calibrated)					

1) For antenna port (CCK 11M)	14	16	18	dBm	
2. Spectrum Mask @ target power					
1) fc +/-11MHz to +/-22MHz	-	-	-30	dBr	
2) fc > +/-22MHz	-	-	-50	dBr	
3 Constellation Error(EVM)@ target power					
1) 1Mbps	-	-	-10	dB	
2) 2Mbps	-	-	-10	dB	
3) 5.5Mbps	-	-	-10	dB	
4) 11Mbps	-	-	-10	dB	
4. Frequency Error	-20	-	20	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
5 Minimum Input Level Sensitivity (each chain)					
1) 1Mbps (FER ≤8%)	-	-	-83	dBm	
2) 2Mbps (FER ≤8%)	-	-	-80	dBm	
3) 5.5Mbps (FER ≤8%)	-	-	-79	dBm	
4) 11Mbps (FER ≤8%)	-	-	-76	dBm	
6 Maximum Input Level (FER ≤8%)	-10	-	-	dBm	

9.2 IEEE 802.11g Section(2.4GHz)

Items	Contents				
Specification	IEEE802.11g				
Mode	OFDM				
Channel	CH1 to CH13				
TX Characteristics	Min.	Typ.	Max.	Unit	Remark
1. Power Levels					
1) For antenna port (54M)	12	14	16	dBm	
2. Spectrum Mask @ target power					
1) at fc +/-11MHz	-	-	-20	dBr	
2) at fc +/-20MHz	-	-	-28	dBr	
3) at fc > +/-30MHz	-	-	-40	dBr	
3 Constellation Error(EVM)@ target power					
1) 6Mbps	-	-	-5	dB	
2) 9Mbps	-	-	-8	dB	
3) 12Mbps	-	-	-10	dB	
4) 18Mbps	-	-	-13	dB	
5) 24Mbps	-	-	-16	dB	
6) 36Mbps	-	-	-19	dB	
7) 48Mbps	-	-	-22	dB	
8) 54Mbps	-	-	-25	dB	
4 Frequency Error	-20	-	20	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	

5 Minimum Input Level Sensitivity (each chain)					
1) 6Mbps (PER $\leq 10\%$)	-	-	-85	dBm	
2) 9Mbps (PER $\leq 10\%$)	-	-	-84	dBm	
3) 12Mbps (PER $\leq 10\%$)	-	-	-82	dBm	
4) 18Mbps (PER $\leq 10\%$)	-	-	-80	dBm	
5) 24Mbps (PER $\leq 10\%$)	-	-	-77	dBm	
6) 36Mbps (PER $\leq 10\%$)	-	-	-73	dBm	
7) 48Mbps (PER $\leq 10\%$)	-	-	-69	dBm	
8) 54Mbps (PER $\leq 10\%$)	-	-	-65	dBm	
6 Maximum Input Level (PER $\leq 10\%$)	-20	-	-	dBm	

9.3 IEEE 802.11n HT20 Section(2.4GHz)

Items	Contents				
Specification	IEEE802.11n HT20 @ 2.4GHz				
Mode	OFDM				
Channel	CH1 to CH13				
TX Characteristics	Min.	Typ.	Max.	Unit	
1. Power Levels					
1) For antenna port (MCS7)	12	14	16	dBm	
2. Spectrum Mask @ target power					
1) at fc +/-11MHz	-	-	-20	dBr	
2) at fc +/-20MHz	-	-	-28	dBr	
3) at fc > +/-30MHz	-	-	-45	dBr	
3. Constellation Error(EVM)@ target power					
1) MCS0	-	-	-5	dB	
2) MCS1	-	-	-10	dB	
3) MCS2	-	-	-13	dB	
4) MCS3	-	-	-16	dB	
5) MCS4	-	-	-19	dB	
6) MCS5	-	-	-22	dB	
7) MCS6	-	-	-25	dB	
8) MCS7	-	-	-28	dB	
4. Frequency Error	-20	-	20	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
5. Minimum Input Level Sensitivity (each chain)					
1) MCS0 (PER $\leq 10\%$)	-	-	-82	dBm	
2) MCS1 (PER $\leq 10\%$)	-	-	-79	dBm	
3) MCS2 (PER $\leq 10\%$)	-	-	-77	dBm	
4) MCS3 (PER $\leq 10\%$)	-	-	-74	dBm	
5) MCS4 (PER $\leq 10\%$)	-	-	-70	dBm	

6) MCS5 (PER $\leq 10\%$)	-	-	-66	dBm	
7) MCS6 (PER $\leq 10\%$)	-	-	-65	dBm	
8) MCS7 (PER $\leq 10\%$)	-	-	-64	dBm	
7. Maximum Input Level (PER $\leq 10\%$)	-20	-	-	dBm	

9.4 IEEE 802.11n HT40 Section(2.4GHZ)

Items	Contents				
Specification	IEEE802.11n HT40 @ 2.4GHz				
Mode	OFDM				
Channel	CH3 to CH11				
TX Characteristics	Min.	Typ.	Max.	Unit	
1. Power Levels (Calibrated)					
1) For antenna port (MCS7)	12	14	16	dBm	
2. Spectrum Mask @target power					
1) at fc +/-22MHz	-	-	-20	dBr	
2) at fc +/-40MHz	-	-	-28	dBr	
3) at fc > +/-60MHz	-	-	-45	dBr	
3. Constellation Error(EVM)@ target power					
1) MCS0	-	-	-5	dB	
2) MCS1	-	-	-10	dB	
3) MCS2	-	-	-13	dB	
4) MCS3	-	-	-16	dB	
5) MCS4	-	-	-19	dB	
6) MCS5	-	-	-22	dB	
7) MCS6	-	-	-25	dB	
8) MCS7	-	-	-28	dB	
4. Frequency Error	-20	-	20	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
5. Minimum Input Level Sensitivity (each chain)					
1) MCS0 (PER ≤10%)	-	-	-79	dBm	
2) MCS1 (PER ≤10%)	-	-	-76	dBm	
3) MCS2 (PER ≤10%)	-	-	-74	dBm	
4) MCS3 (PER ≤10%)	-	-	-71	dBm	
5) MCS4 (PER ≤10%)	-	-	-67	dBm	
6) MCS5 (PER ≤10%)	-	-	-63	dBm	
7) MCS6 (PER ≤10%)	-	-	-62	dBm	
8) MCS7 (PER ≤10%)	-	-	-61	dBm	
6. Maximum Input Level (PER ≤10%)	-20	-	-	dBm	

9.5 IEEE 802.11ax Section(2.4GHz)

Items	Contents					
Specification	IEEE802.11ax					
Mode	BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM and OFDMA					
Channel	HE20: CH1 to CH13 HE40: CH3 to CH11					
TX Characteristics	Min.	Typ.	Max.		Unit	
1. Power Levels (Calibrated)						
1) For antenna port (MCS11)	11	13	15		dBm	
2. Spectrum Mask @VHT20/VHT40/VHT80 target power						
1) at fc +/-11MHz/21MHz/41MHz	-	-	-20		dBm	
2) at fc +/-20MHz/40MHz/80MHz	-	-	-28		dBm	
3) at fc +/-30MHz/60MHz/120MHz	-	-	-40		dBm	
3. Constellation Error(EVM)@ target power						
1) MCS0	-	-	-5		dB	
2) MCS1	-	-	-10		dB	
3) MCS2	-	-	-13		dB	
4) MCS3	-	-	-16		dB	
5) MCS4	-	-	-19		dB	
6) MCS5	-	-	-22		dB	
7) MCS6	-	-	-25		dB	
8) MCS7	-	-	-27		dB	
9) MCS8	-	-	-30		dB	
10) MCS9	-	-	-32		dB	
11) MCS10	-	-	-34		dB	
12) MCS11	-	-	-35		dB	
4. Frequency Error	-20	-	20		ppm	
RX Characteristics	Min.	Typ.	Max.		Unit	
5. Minimum Input Level Sensitivity (each chain)			HE 20	HE 40		
1) MCS0 (PER ≤10%)	-	-	-82	-79	dBm	
2) MCS1 (PER ≤10%)	-	-	-79	-76	dBm	
3) MCS2 (PER ≤10%)	-	-	-77	-74	dBm	
4) MCS3 (PER ≤10%)	-	-	-74	-71	dBm	
5) MCS4 (PER ≤10%)	-	-	-70	-67	dBm	
6) MCS5 (PER ≤10%)	-	-	-66	-63	dBm	
7) MCS6 (PER ≤10%)	-	-	-65	-62	dBm	
8) MCS7 (PER ≤10%)	-	-	-64	-61	dBm	

9) MCS8(PER $\leq 10\%$)	-	-	-59	-56		dBm	
10) MCS9(PER $\leq 10\%$)	-	-	-57	-54		dBm	
11) MCS10(PER $\leq 10\%$)	-	-	-54	-51		dBm	
12) MCS11(PER $\leq 10\%$)	-	-	-52	-49		dBm	
6. Maximum Input Level (PER $\leq 10\%$)	-30	-		-		dBm	

9.6 IEEE 802.11a Section(5GHz)

Items	Contents					
Specification	IEEE802.11a					
Mode	OFDM					
Channel	CH36 to CH165					
TX Characteristics	Min.	Typ.	Max.	Unit		
1. Power Levels (Calibrated)						
1) For antenna port (54M)	12	14	16	dBm		
2. Spectrum Mask @target power						
1) at fc +/-11MHz	-	-	-20	dBr		
2) at fc +/-20MHz	-	-	-28	dBr		
3) at fc > +/-30MHz	-	-	-40	dBr		
3. Constellation Error(EVM)@ target power						
1) 6Mbps	-	-	-5	dB		
2) 9Mbps	-	-	-8	dB		
3) 12Mbps	-	-	-10	dB		
4) 18Mbps	-	-	-13	dB		
5) 24Mbps	-	-	-16	dB		
6) 36Mbps	-	-	-19	dB		
7) 48Mbps	-	-	-22	dB		
8) 54Mbps	-	-	-25	dB		
4 Frequency Error	-20	-	20	ppm		
RX Characteristics	Min.	Typ.	Max.	Unit		
5 Minimum Input Level Sensitivity (each chain)						
1) 6Mbps (PER $\leq 10\%$)	-	-	-82	dBm		
2) 9Mbps (PER $\leq 10\%$)	-	-	-81	dBm		
3) 12Mbps (PER $\leq 10\%$)	-	-	-79	dBm		
4) 18Mbps (PER $\leq 10\%$)	-	-	-77	dBm		
5) 24Mbps (PER $\leq 10\%$)	-	-	-74	dBm		
6) 36Mbps (PER $\leq 10\%$)	-	-	-70	dBm		
7) 48Mbps (PER $\leq 10\%$)	-	-	-66	dBm		
8) 54Mbps (PER $\leq 10\%$)	-	-	-65	dBm		
6. Maximum Input Level (PER $\leq 10\%$)	-30	-	-	dBm		

9.7 IEEE 802.11n HT20 Section(5GHz)

Items	Contents				
Specification	IEEE802.11n HT20 @ 5GHz				
Mode	BPSK, QPSK, 16QAM, 64QAM and OFDM				
Channel	CH36 to CH165				
TX Characteristics	Min.	Typ.	Max.	Unit	
1. Power Levels (Calibrated)					
1) For antenna port (MCS7)	12	14	16	dBm	
2. Spectrum Mask @target power					
1) at fc +/-11MHz	-	-	-20	dBr	
2) at fc +/-20MHz	-	-	-28	dBr	
3) at fc > +/-30MHz	-	-	-45	dBr	
3. Constellation Error(EVM)@ target power					
1) MCS0	-	-	-5	dB	
2) MCS1	-	-	-10	dB	
3) MCS2	-	-	-13	dB	
4) MCS3	-	-	-16	dB	
5) MCS4	-	-	-19	dB	
6) MCS5	-	-	-22	dB	
7) MCS6	-	-	-25	dB	
8) MCS7	-	-	-28	dB	
4. Frequency Error	-20	-	20	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
6. Minimum Input Level Sensitivity (each chain)					
1) MCS0 (PER ≤10%)	-	-	-82	dBm	
2) MCS1 (PER ≤10%)	-	-	-79	dBm	
3) MCS2 (PER ≤10%)	-	-	-77	dBm	
4) MCS3 (PER ≤10%)	-	-	-74	dBm	
5) MCS4 (PER ≤10%)	-	-	-70	dBm	
6) MCS5 (PER ≤10%)	-	-	-66	dBm	
7) MCS6 (PER ≤10%)	-	-	-65	dBm	
8) MCS7 (PER ≤10%)	-	-	-64	dBm	
6. Maximum Input Level (PER ≤10%)	-30	-	-	dBm	

9.8 IEEE 802.11n HT40 Section(5GHz)

Items	Contents				
Specification	IEEE802.11n HT40 @ 5GHz				
Mode	BPSK, QPSK, 16QAM, 64QAM and OFDM				
Channel	CH38 to CH163				
TX Characteristics	Min.	Typ.	Max.	Unit	
1. Power Levels (Calibrated)					
1) For antenna port (MCS7)	12	14	16	dBm	
2. Spectrum Mask @target power					
1) at fc +/-21MHz	-	-	-20	dBm	
2) at fc +/-40MHz	-	-	-28	dBm	
3) at fc > +/-60MHz	-	-	-45	dBm	
3. Constellation Error(EVM)@ target power					
1) MCS0	-	-	-5	dB	
2) MCS1	-	-	-10	dB	
3) MCS2	-	-	-13	dB	
4) MCS3	-	-	-16	dB	
5) MCS4	-	-	-19	dB	
6) MCS5	-	-	-22	dB	
7) MCS6	-	-	-25	dB	
8) MCS7	-	-	-28	dB	
4. Frequency Error	-20	-	20	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
7. Minimum Input Level Sensitivity (each chain)					
1) MCS0 (PER ≤10%)	-	-	-79	dBm	
2) MCS1 (PER ≤10%)	-	-	-76	dBm	
3) MCS2 (PER ≤10%)	-	-	-74	dBm	
4) MCS3 (PER ≤10%)	-	-	-71	dBm	
5) MCS4 (PER ≤10%)	-	-	-67	dBm	
6) MCS5 (PER ≤10%)	-	-	-63	dBm	
7) MCS6 (PER ≤10%)	-	-	-62	dBm	
8) MCS7 (PER ≤10%)	-	-	-61	dBm	
6. Maximum Input Level (PER ≤10%)	-30	-	-	dBm	

9.9 IEEE 802.11ac Section(5GHz)

Items	Contents					
Specification	IEEE802.11ac					
Mode	BPSK, QPSK, 16QAM, 64QAM ,256QAM and OFDM					
Channel	CH36 to CH165 VHT20 CH38 to CH163 VHT40 CH42 to CH157 VHT80					
TX Characteristics	Min.	Typ.	Max.		Unit	
1. Power Levels (Calibrated)						
1) For antenna port (MCS9)	12	14	16		dBm	
2. Spectrum Mask @VHT20/VHT40/VHT80 target power						
1) at fc +/-11MHz/21MHz/41MHz	-	-	-20		dBr	
2) at fc +/-20MHz/40MHz/80MHz	-	-	-28		dBr	
3) at fc +/-30MHz/60MHz/120MHz	-	-	-40		dBr	
3. Constellation Error(EVM)@ target power						
1) MCS0	-	-	-5		dB	
2) MCS1	-	-	-10		dB	
3) MCS2	-	-	-13		dB	
4) MCS3	-	-	-16		dB	
5) MCS4	-	-	-19		dB	
6) MCS5	-	-	-22		dB	
7) MCS6	-	-	-25		dB	
8) MCS7	-	-	-27		dB	
9) MCS8	-	-	-30		dB	
10) MCS9	-	-	-32		dB	
4. Frequency Error	-20	-	20		ppm	
RX Characteristics	Min.	Typ.	Max.		Unit	
5.Minimum Input Level Sensitivity (each chain)			VHT 20	VHT 40	VHT 80	
1) MCS0 (PER ≤10%)	-	-	-82	-79	-76	dBm
2) MCS1 (PER ≤10%)	-	-	-79	-76	-73	dBm
3) MCS2 (PER ≤10%)	-	-	-77	-74	-71	dBm
4) MCS3 (PER ≤10%)	-	-	-74	-71	-68	dBm
5) MCS4 (PER ≤10%)	-	-	-70	-67	-64	dBm
6) MCS5 (PER ≤10%)	-	-	-66	-63	-60	dBm
7) MCS6 (PER ≤10%)	-	-	-65	-62	-59	dBm
8) MCS7 (PER ≤10%)	-	-	-64	-61	-58	dBm
9) MCS8(PER ≤10%)	-	-	-59	-56	-53	dBm
10) MCS9(PER ≤10%)	-	-	-57	-54	-51	dBm

6. Maximum Input Level (PER $\leq 10\%$)	-30	-	-	dBm	
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9.10 IEEE 802.11ax Section(5GHz)

Items	Contents					
Specification	IEEE802.11ax					
Mode	BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM and OFDMA					
Channel	CH36 to CH165 HE20 CH38 to CH163 HE40 CH42 to CH157 HE80					
TX Characteristics	Min.	Typ.	Max.			Unit
1. Power Levels (Calibrated)						
1) For antenna port (MCS11)	11	13	15			dBm
2. Spectrum Mask @HE20/HE40/HE80 target power						
1) at fc +/-11MHz/21MHz/41MHz	-	-	-20			dBr
2) at fc +/-20MHz/40MHz/80MHz	-	-	-28			dBr
3) at fc +/-30MHz/60MHz/120MHz	-	-	-40			dBr
3. Constellation Error(EVM)@ target power						
1) MCS0	-	-	-5			dB
2) MCS1	-	-	-10			dB
3) MCS2	-	-	-13			dB
4) MCS3	-	-	-16			dB
5) MCS4	-	-	-19			dB
6) MCS5	-	-	-22			dB
7) MCS6	-	-	-25			dB
8) MCS7	-	-	-27			dB
9) MCS8	-	-	-30			dB
10) MCS9	-	-	-32			dB
11) MCS10			-34			dB
12) MCS11			-35			dB
4. Frequency Error	-20	-	20			ppm
RX Characteristics	Min.	Typ.	Max.			Unit
5. Minimum Input Level Sensitivity (each chain)			HE 20	HE 40	HE 80	
1) MCS0 (PER $\leq 10\%$)	-	-	-82	-79	-76	dBm
2) MCS1 (PER $\leq 10\%$)	-	-	-79	-76	-73	dBm
3) MCS2 (PER $\leq 10\%$)	-	-	-77	-74	-71	dBm
4) MCS3 (PER $\leq 10\%$)	-	-	-74	-71	-68	dBm
5) MCS4 (PER $\leq 10\%$)	-	-	-70	-67	-64	dBm
6) MCS5 (PER $\leq 10\%$)	-	-	-66	-63	-60	dBm
7) MCS6 (PER $\leq 10\%$)	-	-	-65	-62	-59	dBm

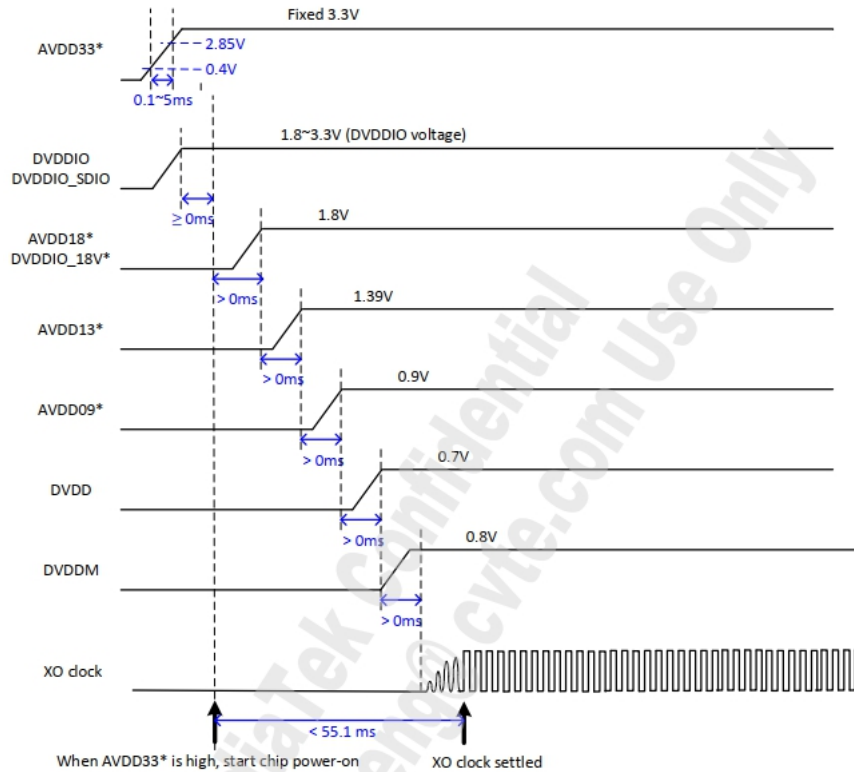
8) MCS7 (PER $\leq 10\%$)	-	-	-64	-61	-58	dBm	
9) MCS8(PER $\leq 10\%$)	-	-	-59	-56	-53	dBm	
10) MCS9(PER $\leq 10\%$)	-	-	-57	-54	-51	dBm	
11) MCS10(PER $\leq 10\%$)	-	-	-54	-51	-48	dBm	
12) MCS11(PER $\leq 10\%$)	-	-	-52	-49	-46	dBm	
6. Maximum Input Level (PER $\leq 10\%$)	-30	-	-			dBm	

9.11 Bluetooth Section

Items	Contents				
Specification	BT2.1+EDR/4.2/5.2 with BLE				
Mode	FHSS,GFSK,DPSK,DQPSK				
Number of Channel	79 Channels				
Frequency Band	2.402 GHz ~2.480GHz				
	Min.	Typ.	Max.	Unit	Remark
1. Output Power	-	8	-	dBm	
2. Gain step	-	1	-	dB	
3. Receiver sensitivity (BER $\leq 0.1\%$)	-	-92	-80	dBm	
4. Maximum usable signal (BER $\leq 0.1\%$)	-20	-	-		
5. C/I co-channel (BER $<0.1\%$)	-	4	11	dB	
6. C/I 1MHz (BER $<0.1\%$)	-	-7	0	dB	
7. C/I 2MHz (BER $<0.1\%$)	-	-40	-30	dB	
8. C/I ≥ 3 MHz (BER $<0.1\%$)	-	-43	-40	dB	
9. C/I Image channel (BER $<0.1\%$)	-	-20	-9	dB	
10. C/I Image 1MHz (BER $<0.1\%$)	-	-35	-20	dB	
11. Inter-modulation	-39	-30	-	dB	
12. Out-of-band blocking					
1). 30MHz to 2000MHz	-10	-	-	dBm	
2). 2000MHz to 2399MHz	-27	-	-	dBm	
3). 2498MHz to 3000MHz	-27	-	-	dBm	
4). 3000MHz to 12.75GHz	-10	-	-	dBm	
13. Modulation characteristics					
1). Δf_{1avg}	140	157	175	KHz	
2). Δf_{2max} (For at least 99.9% of all Δf_{2max})	115	145	-	KHz	
3). $\Delta f_{1avg} / \Delta f_{2avg}$	0.8	0.98	-	KHz	
14. ICFT	-75	± 18	+75	KHz	
15. Carrier frequency drift					
1). One slot packet (DH1)	-25	± 15	+25	KHz	
2). Two slot packet (DH3)	-40	± 15	+40	KHz	
3). Five slot packet (DH5)	-40	± 15	+40	KHz	
4). Max drift rate	-	10	20	KHz/50us	
16. TX output spectrum(20dB bandwidth)	-	922	1000	KHz	
17. In-Band spurious emission					

1). $\pm 2\text{MHz}$ offset	-	-38	-20	dBm	
2). $\pm 3\text{MHz}$ offset	-	-43	-40	dBm	
3). $> \pm 3\text{MHz}$ offset	-	-45	-40	dBm	

9.12 Chip power on sequence



10. Mechanical, Environmental and Reliability Tests

Test Items		Test Conditions	Qty	Criteria Condition
10-1	Drop test	The packed samples was tested at below condition: Drop height: 760mm(0.5~9.5kg) 610mm(9.5~18.5kg) Drop time: 1x corner, 3x edge and 6x face.	1xBox	After test, the outer box and inner box will not been broken by appearance visual inspection, and the products should be ok.
10-2	Vibration test	X-Y-Z direction, first Frequency changing from 10Hz to 30Hz to 10Hz, amplitude 2.0mm, 5 times vibrations, 5x times vibration.	1xBox	After test, the outer box and inner box will not been broken by appearance visual inspection and the products should be ok.

10-3	Soldering ability test (Only for SKI module)	Soldering temperature: 245±5℃ Soldering duration: 3±0.5S	3	1.After soldering, the soldered area must be covered by a smooth bright solder layer, some deficiencies such as a small amount of the pinhole, not wetting are allowed, but the deficiencies can not be in the same place; 2. At least 90% of soldered area shall be covered continuously by the soldering material.
10-4	High Temperature and Humidity Operation Test	Leave samples in 60℃, 90% RH @ 24 hours	4	After test, the products appearance, power, EVM and frequency error functional parameter shall be satisfied with the test specification.
10-5	Low Temperature Operation Test	Leave samples in -15℃ @24 hours	4	After test, the products appearance, power, EVM and frequency error functional parameter shall be satisfied with the test specification.
10-6	High Temperature and Humidity Start Test	Leave samples in 60℃, 90% RH for 4x hours	4	After test, power on and off the samples for 3x tiems, the samples should be able to start normally
10-7	Low temperature start test	Leave samples in -15℃ for 4x hours	4	After test, power on and off the samples for 3x tiems, the samples should be able to start normally
10-8	High Temperature and Humidity Storage Test	Leave samples in 85℃, 95% RH @ 48 hours	4	After test, the products appearance, power, EVM and frequency error functional parameter shall be satisfied with the test specification.
10-9	Low Temperature Storage Test	Leave samples in -40℃, @48 hours	4	After test, the products appearance, power, EVM and frequency error functional parameter shall be satisfied with the test specification.
10-10	Thermal Shock Test	-40~85℃, dwell time: 30min, 50cycles	4	After test, the products appearance, power, EVM and frequency error functional parameter shall be satisfied with the test specification.
10-11	Aging Test	60℃, 120Hrs	10	The products at high temperature for a long time can continuous work normally

10-12	Salt spray test	NSS,35C,PH:6.5~7.2, 24H	2	The Sample shall has no minor or major defects, such as physical damage, crack, corrosion, deformation etc;
10-13	ESD	Discharge voltage: 1kV C: 50pF Discharge resistance: 330Ω Positive10 times 1 time for each second	3	The products can recoverable smoothly after ESD test.

11. Reference Design（参考设计）（未更新）

11.1 SCH 参考

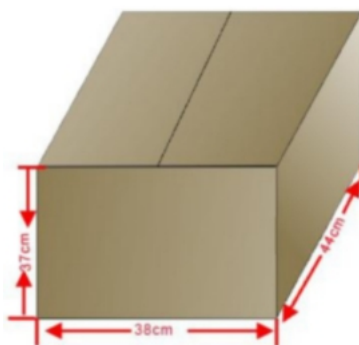
11.2 PCB 参考

12. Package（包装）（未更新）

（1）编带尺寸

（2）编带方向：（箭头代表编带走向）

（3）包装示意图：



（4）包装数量：

13. Reflow Profile（回流焊温度曲线）

13.1 Storage requirements（存储要求）

本产品的湿敏特性为 4 级（MSL4），出厂时以真空密封袋包装。产品搬运、存储、加工过程必须遵循 IPC/JEDEC J-STD-033。在环境温度低于 40 摄氏度，空气湿度小于 90% 的情况下，真空包装下产品可存放 12 个月。在产品存放有效期内，如发现真空包装有漏气、湿敏卡变色达到烘烤标准、开封暴露时间超过 72H，需要烘烤后使用。

13.2 Production parameters（生产参数）

炉温最高不能超过 250℃，推荐是 240℃。

推荐 SMT 焊炉温曲线如下图所示。

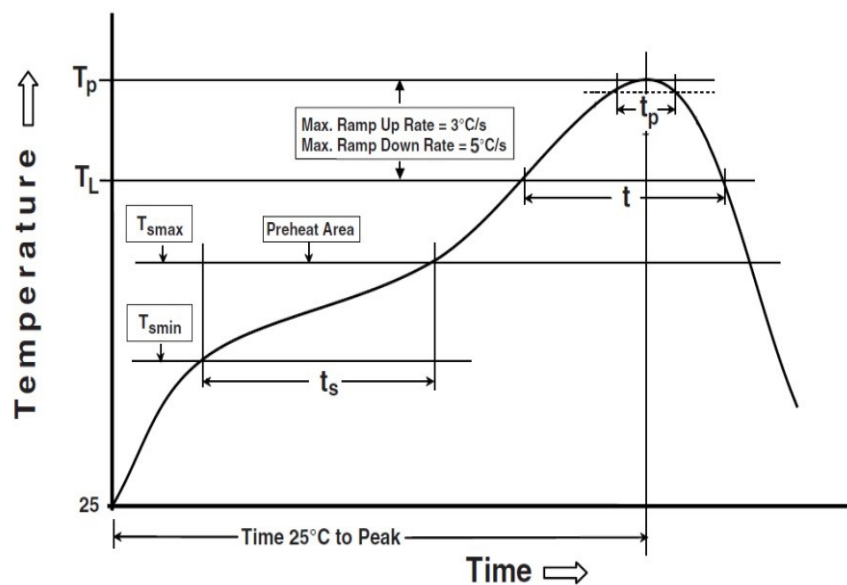


图 13-1 炉温曲线推荐图

表 13-2 炉温曲线参数

炉温参数	最小值	典型值	最大值	单位
预热区最低温度 Tsmmin	150			℃
预热区最高温度 Tsmmax			200	℃
预热上升时间 ts	80		120	s
回流焊区升温速率(TL 到 Tp)			3	℃/s
回流焊区低温 TL		220		℃
回流焊区峰值温度 Tp	235	240	250	℃
回流焊峰值温度时间 tp(Tp 波动 5℃ 范围)			30	s
回流焊区冷却降温速率 (Tp 到 TL)	-5	-3	-1	℃/s
回流时间 t	40		60	s

According to country code, channel 12 and 13 would be disabled in North America.

FCC Statement:

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.

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 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.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

List of applicable FCC rules

This module has been tested and found to comply with [part 15](#), [part 2](#) requirements for Modular Approval.

Antenna Placement Within the Host Platform

The module is tested for standalone mobile RF exposure use condition.

(1) The antenna must be installed such that 20 cm is maintained between the antenna and users,

(2) The transmitter module may not be co-located with any other transmitter or antenna.

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

RF exposure considerations

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Antenna Type and Gain

The following antennas have been certified for use with this module.

Only antennas of the same type with equal or lower gain may also be used with this module. Other types of antennas and/or higher gain antennas may require the additional authorization for operation.

Antenna Specification list below:

Antenna Type	Frequency Bands	Max. Antenna Gain (dBi)
External Antenna (BT)	2.4GHz	2.71
External Antenna (WiFi)	2.4GHz	3.86
External Antenna (WiFi)	5GHz	4.74

End Product Labeling

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: “[Contains FCC ID: 2AR82-SKIWB920TU2](#)”. The FCC ID can be used only when all FCC compliance requirements are met.

The end product shall bear the following 15.19 statement: 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.

Information on test modes and additional testing requirements

This transmitter is tested in a standalone mobile RF exposure condition and any co-located or simultaneous transmission with other transmitter(s) class II permissive change re-evaluation or new certification.

Part 15 Subpart B disclaimer

This transmitter module is tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B rule requirement applicable to the final host. The final host will still need to be reassessed for compliance to this portion of rule requirements if applicable.

As long as all conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Important Note

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered

valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for reevaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

Manual Information to the End User

The OEM integrator 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 host integrator must follow the integration instructions provided in this document and ensure that the composite-system end product complies with the requirements by a technical assessment or evaluation to the rules and to KDB Publication 996369.

The host integrator installing this module into their product must ensure that the final composite product complies with the requirements by a technical assessment or evaluation to the rules, including the transmitter operation and should refer to guidance in KDB 996369.

OEM/Host manufacturer responsibilities

OEM/Host manufacturers are ultimately responsible for the compliance of the Host and Module. The final product must be reassessed against all the essential requirements of the FCC rule such as FCC Part 15 Subpart B before it can be placed on the US market. This includes reassessing the transmitter module for compliance with the Radio and EMF essential requirements of the FCC rules. This module must not be incorporated into any other device or system without retesting for compliance as multi-radio and combined equipment

ISED Statement:

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de classe B est conforme à la norme canadienne ICES-003.

This device complies with Innovation, Science and Economic Development Canada's licence-exempt RSS standard(s).

Operation is subject to the following two conditions:

- 1) This device may not cause interference, and
- 2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes:

- 1) *l'appareil ne doit pas produire de brouillage, et*
- 2) *l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

RF Radiation Exposure Statement

This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

Operation in the band 5150-5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems.

Déclaration d'exposition aux radiations

Cet appareil est conforme aux limites d'exposition aux rayonnements définies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé à une distance minimale de XX centimètres entre le radiateur et votre corps.

Le fonctionnement dans la bande 5150-5250 MHz est uniquement destiné à une utilisation en intérieur afin de réduire le potentiel d'interférences nuisibles aux systèmes mobiles par satellite dans le même canal.

IMPORTANT NOTE

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the IC can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

NOTE IMPORTANTE

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considérée comme valide et IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

Required end product labeling

This transmitter module is authorized only for use in device where the antenna may be installed and operated with greater than 20cm between the antenna and users. The final end product must be labeled in a visible area with the following: “[Contains IC: 24728-SKIWB920TU2](#)”.

Plaque signalétique du produit final

Ce module émetteur est autorisé uniquement pour une utilisation dans un appareil où l'antenne peut être installée et utilisée à plus de 20 cm entre l'antenne et les utilisateurs. Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "[Contient des IC: 24728-SKIWB920TU2](#)".

Manual Information To the End User

The OEM integrator 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 show in this manual.

The following text, or an equivalent notice, that shall be displayed in a conspicuous location, either in the user manual or on the device, or both:

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- 1) This device may not cause interference.
- 2) This device must accept any interference, including interference that may cause undesired operation of the device.

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

l'énoncé qui suit, ou l'équivalent, à un endroit bien en vue dans le manuel d'utilisation ou sur l'appareil, ou encore aux deux endroits :

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- 1. L'appareil ne doit pas produire de brouillage;*
- 2. L'appareil doit accepter toute interférence, y compris toute interférence pouvant entraîner un fonctionnement indésirable du dispositif.*

Antennas

The following antennas have been certified for use with this module; antennas of the same type with equal or lower gain may also be used with this module. The antenna must be installed such that 20 cm can be maintained between the antenna and users.

This radio transmitter has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Antenna Specification list below:

Antenna Type	Frequency Bands	Max. Antenna Gain (dBi)
External Antenna (BT)	2.4GHz	2.71
External Antenna (WiFi)	2.4GHz	3.86
External Antenna (WiFi)	5GHz	4.74

ANTENNE

Les antennes suivantes ont été certifiées pour une utilisation avec ce module; des antennes du même type à gain égal ou inférieur peuvent également être utilisées avec ce module. L'antenne doit être installée de telle sorte que 20 cm puissent être maintenus entre l'antenne et les utilisateurs.

Cet émetteur radio a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous, avec le gain maximal autorisé indiqué. Les types d'antenne non inclus dans cette liste qui ont un gain supérieur au gain maximum indiqué pour tout type répertorié sont strictement interdits pour l'utilisation avec cet appareil.