BL-M7921E-1X

WiFi6 + BT5.2 Combo

M.2 Module Specification

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TOP VIEW

BOTTOM VIEW

Module Name: BL-M7921E-1X	
Module Type: 802.11a/b/g/n/ac/ax + Bluetooth 5.2 Combo M.2 Module	
Revision: V0.1	
Customer Approval:	
Company:	
Title:	
Signature:	Date:
BL-link Approval:	
Title:	
Signature:	Date:

Revision History

Revision	Summary	Release Date
0.1	Initial release	2022-08-15

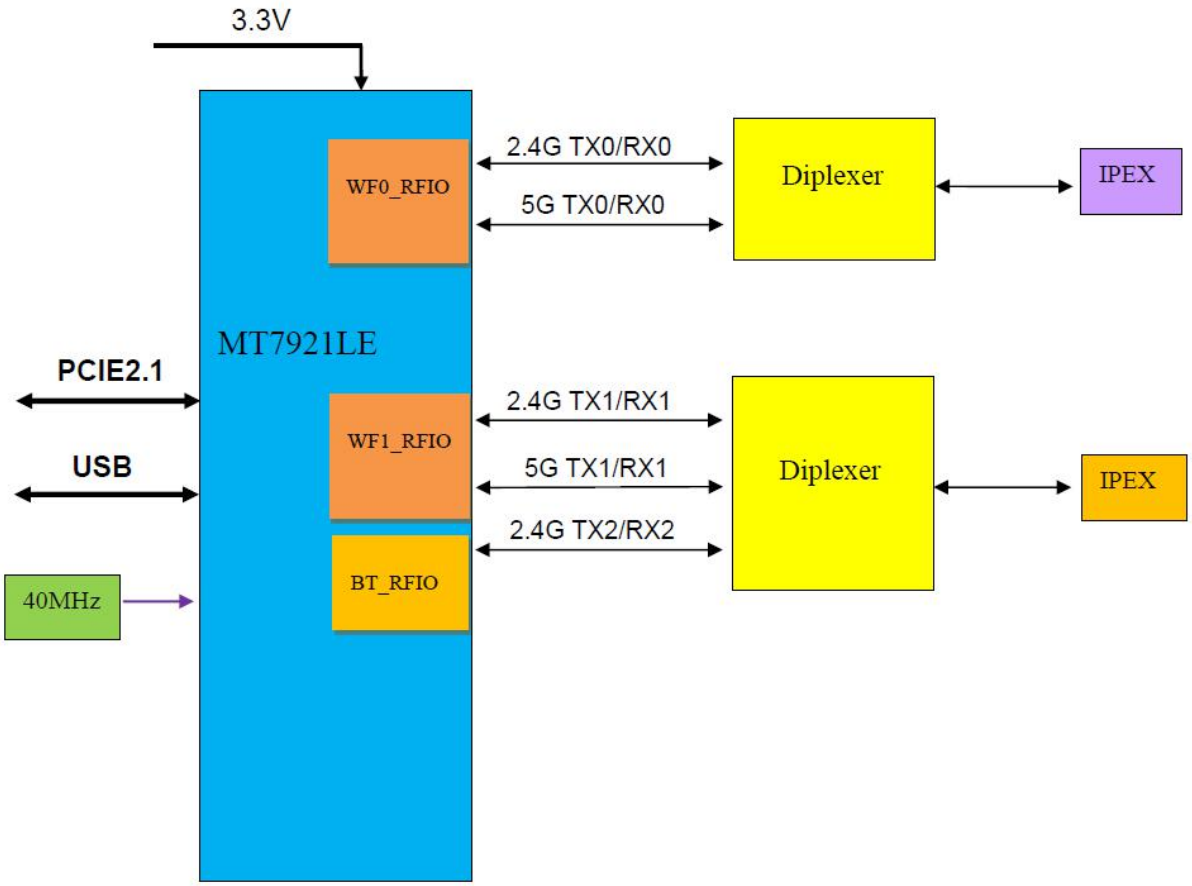
1. Introduction

BL-M7921E-1X module design is based on MediaTek MT7921LEN solution, MT7921ALE 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.

1.1 Features

- Operating Frequencies: 2.4~2.4835GHz or 5.15~5.85GHz
- Host Interface is PCI-E and USB
- IEEE Standards: IEEE 802.11a/b/g/n/ac/ax
- Wireless data rate can reach up to 573.5Mbps or 1201Mbps
- External Antennas Design
- VDD3.3V±0.2V main power supply

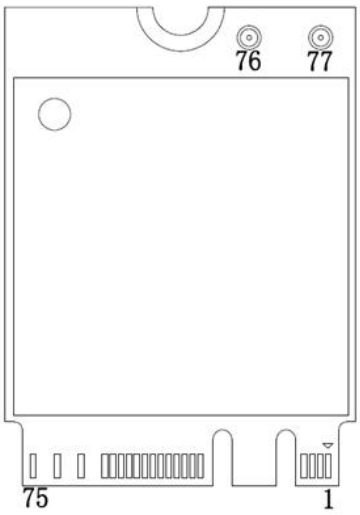
1.2 Block Diagram



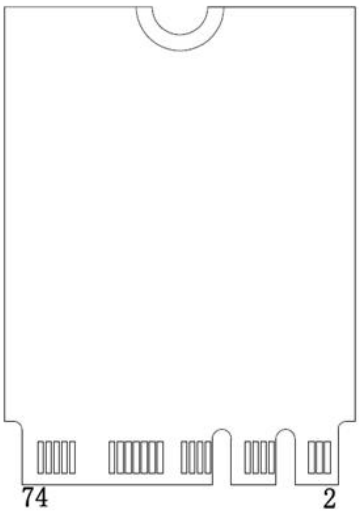
1.3 General Specifications

Module Name	BL-M7921E-1X 802.11ax + Bluetooth 5.2 Combo PCI-E Module
Chipset	MediaTek MT7921LEN
WLAN Standards	IEEE802.11a/b/g/n/ac/ax
Host Interface	PCIE for WLAN; USB for Bluetooth
Antenna	Connect to external antenna through IPEX connectors
Dimension	22*30*2.3mm (L*W*H)
Power Supply	DC 3.3V±0.3V
Power Consumption (WIFI TX)	640mA
Power Consumption (WIFI RX)	120mA
Power Consumption (BT TX)	53mA
Power Consumption (BT RX)	13mA
Operation Temperature	-10℃ to +70℃
Operation Humidity	10% to 95% RH (Non-Condensing)
Storage Temperature	-45℃ to +85℃
Storage umidity	10% to 95% RH (Non-Condensing)

2. Pin Assignments



TOP View



BOT View

2.1 Pin Definition

TOP				BOT			
No	Definition	Type	Description	No	Definition	Type	Description
1	GND	P	Ground	2	+3.3V	P	+3.3V
3	USB_D+	I/O	USB Transmitter/Receiver Differential Pair for BT	4	+3.3V	P	+3.3V
5	USB_D-	I/O	USB Transmitter/Receiver Differential Pair for BT	6	LED_WLAN	O	Status indicators via LED devices that will be provided by the system
7	GND	P	Ground	8	NC	--	No connection(floating)
9	NC	--	No connection(floating)	10	NC	--	No connection(floating)
11	NC	--	No connection(floating)	12	NC	--	No connection(floating)
13	NC	--	No connection(floating)	14	NC	--	No connection(floating)
15	NC	--	No connection(floating)	16	LED_BT	O	Status indicators via LED devices that will be provided by the system and it is an open drain
17	NC	--	No connection(floating)	18	GND	P	GND
19	NC	--	No connection(floating)	20			
21	NC	--	No connection(floating)	22	NC	--	No connection(floating)
23	NC	--	No connection(floating)	24	NC	--	No connection(floating)
25	NC	--	No connection(floating)	26	NC	--	No connection(floating)
27	NC	--	No connection(floating)	28	NC	--	No connection(floating)
29	NC	--	No connection(floating)	30	NC	--	No connection(floating)
31	NC	--	No connection(floating)	32	NC	--	No connection(floating)
33	GND	P	Ground	34	NC	--	No connection(floating)
35	PERP0		PCIE_RX0_P	36	NC	--	No connection(floating)
37	PERN0	I/O	PCIE_RX0_N	38	NC	--	No connection(floating)
39	GND	P	GND	40	NC	--	No connection(floating)
41	PETP0	I/O	PCIE_TX0_P	42	NC	--	No connection(floating)
43	PETN0	I/O	PCIE_TX0_N	44	NC	--	No connection(floating)
45	GND	P	GND	46	NC	--	No connection(floating)
47	REFCLKP0	I	PCIE_CLK_P	48	NC	--	No connection(floating)

49	REFCLKN0	I	PCIE_CLK_N	50	NC	--	No connection(floating)
51	GND	P	GND	52	PERST_L	I	Input signal for functional reset to the card
53	CLKREQN	O	CLKEQ_N_1	54	BT_DIS_N	I	BT_RF_DIS_B
55	PEWAKEN	O	WAKE_N	56	WL_DIS_N	I	WF_RF_DIS_B
57	GND	P	GND	58	NC	--	No connection(floating)
59	NC	--	No connection(floating)	60	NC	--	No connection(floating)
61	NC	--	No connection(floating)	62	NC	--	No connection(floating)
63	GND	P	GND	64	NC	--	No connection(floating)
65	NC	--	No connection(floating)	66	NC	--	No connection(floating)
67	NC	--	No connection(floating)	68	NC	--	No connection(floating)
69	GND	P	GND	70	NC	--	No connection(floating)
71	NC	--	No connection(floating)	72	+3.3V	P	+3.3V
73	NC	--	No connection(floating)	74	+3.3V	P	+3.3V
75	GND	P	GND				
76	ANT1	RF	2.4/5G/ ANT1				
77	ANT2	RF	2.4/5G/ ANT1/ BT ANT1				

P: Power, I: Input, O: Output, I/O: In/Output, RF: Analog RF Port

3. Electrical and Thermal Specifications

3.1 Recommended Operating Conditions

Parameters		Min	Typ	Max	Units
Ambient Operating Temperature		-10	25	70	℃
External Antenna VSWR			1.7	2	/
Supply Voltage	VDD33	3.0	3.3	3.6	V

3.2 Current Consumption

Conditions : VDD=3.3V ; Ta:25℃			
Use Case	VDD33 Current (average)		
	Typ	Max	Units
Power Consumption (WIFI TX)	640	/	mA

Power Consumption (WIFI RX)	120	/	mA
Power Consumption (BT TX)	53	/	mA
Power Consumption (BT RX)	13	/	mA

4. WLAN & Bluetooth RF Specifications

4.1 2.4G WLAN RF Specification

Conditions : VDD=3.3V ; Ta:25℃			
Features	**Description**		
WLAN Standard	IEEE 802.11b/g/n		
Frequency Range	2.4~2.4835GHz (2.4GHz ISM Band)		
Channels	Ch1~Ch13 (For 20MHz Channels)		
Modulation	802.11b (DSSS): CCK, DQPSK, DBPSK; 802.11g (OFDM): BPSK, QPSK, QAM16, QAM64; 802.11n (OFDM): BPSK, QPSK, QAM16, QAM64;		
Date Rate	802.11b: 1, 2, 5.5, 11Mbps; 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps; 802.11n (HT20): MCS0~MCS7(1T1R_SISO) 6.5~72.2Mbps; 802.11n (HT20): MCS8~MCS15(2T2R_MIMO) 13~144.4Mbps; 802.11n (HT40): MCS0~MCS7(1T1R) 13.5~150Mbps; 802.11n (HT40): MCS8~MCS15(2T2R) 27~300Mbps;		
Frequency Tolerance	±20ppm		
2.4G Transmitter Specifications			
TX Rate	**TX Power（dBm)**	**TX Power Tolerance（dB)**	**EVM（dB)**
802.11b@1~11Mbps	18.5	±2	≦-15
802.11g@6Mbps	15	±2	≦-15
802.11g@54Mbps	15	±2	≦-25
802.11n@HT20_MCS0	15	±2	≦-10
802.11n@HT20_MCS7	15	±2	≦-28
802.11n@HT40_MCS0	14	±2	≦-10
802.11n@HT40_MCS7	14	±2	≦-28
802.11ax@HE_SU20_MCS11	13	±2	≦-35
802.11ax@HE_SU40_MCS11	13	±2	≦-35
2.4G Receiver Specifications			
RX Rate	**Min Input Level（dBm)**	**Max Input Level（dBm)**	**PER**
802.11b@1Mbps	-95	10	< 8%

802.11b@11Mbps	-89	10	< 8%
802.11g@6Mbps	-95	-2	< 10%
802.11g@54Mbps	-77	-2	< 10%
802.11n@HT20_MCS0	-95	-2	< 10%
802.11n@HT20_MCS7	-76	-2	< 10%
802.11n@HT40_MCS0	-91	-2	< 10%
802.11n@HT40_MCS7	-72	-2	< 10%
802.11ax@HE_SU20_MCS11	-53	-5	< 10%
802.11ax@HE_SU40_MCS11	-49	-5	< 10%

4.2 5G WLAN RF Specification

Conditions : VDD=3.3V ; Ta:25℃	
Features	**Description**
WLAN Standard	IEEE 802.11a/n/ac/ax
Frequency Range	5.15~5.25GHz; 5.25~5.35GHz; 5.47~5.73GHz; 5.735~5.835GHz (5GHz ISM Band)
Channels	Ch36, Ch40, Ch44, Ch48; Ch52~Ch64; Ch100~Ch140; Ch149~Ch165 (For 20MHz Channels)
Modulation	802.11a (OFDM): BPSK, QPSK, QAM16, QAM64; 802.11n (OFDM): BPSK, QPSK, QAM16, QAM64; 802.11ac (OFDM): BPSK, QPSK, QAM16, QAM64, QAM256; 802.11ax (OFDMA): BPSK, BPSK_DCM, QPSK, QPSK_DCM, QAM16, QAM16_DCM, QAM64, QAM256, QAM1024;
Date Rate	802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps; 802.11n (HT20): MCS0~MCS7(1T1R_SISO) 6.5~72.2Mbps; 802.11n (HT20): MCS8~MCS15(2T2R_MIMO) 13~144.4Mbps; 802.11n (HT40): MCS0~MCS7(1T1R) 13.5~150Mbps; 802.11n (HT40): MCS8~MCS15(2T2R) 27~300Mbps; 802.11ac (VHT20): MCS0~MCS8(1T1R) 6.5~86.7Mbps; 802.11ac (VHT20): MCS0~MCS8(2T2R) 13~173.3Mbps; 802.11ac (VHT40): MCS0~MCS9(1T1R)13.5~200Mbps; 802.11ac (VHT40): MCS0~MCS9(2T2R)27~400Mbps; 802.11ac (VHT80): MCS0~MCS9(1T1R)29.3~433.3Mbps;

	802.11ac (VHT80): MCS0~MCS9(2T2R)58.5~866.7Mbps; 802.11ax (HE_MU,26~484RU): MCS0~MCS11(1T1R) 0.4~286.8Mbps; 802.11ax (HE_MU,26~484RU): MCS0~MCS11(2T2R) 0.8~573.5Mbps; 802.11ax (HE_SU, non-OFDMA 20MHz): MCS0~MCS11(1T1R) 3.6~143.4Mbps; 802.11ax (HE_SU, non-OFDMA 20MHz): MCS0~MCS11(2T2R) 7.3~286.8Mbps; 802.11ax (HE_SU, non-OFDMA 40MHz): MCS0~MCS11(1T1R) 7.3~286.8Mbps; 802.11ax (HE_SU,non-OFDMA 40MHz): MCS0~MCS11(2T2R) 14.6~573.5Mbps; 802.11ax (HE_SU,non-OFDMA 80MHz): MCS0~MCS11(1T1R) 15.3~600.4Mbps; 802.11ax (HE_SU, non-OFDMA 80MHz): MCS0~MCS11(2T2R) 30.6~1201Mbps;
Frequency Tolerance	≦ ±20ppm

5G Transmitter Specifications			
TX Rate	TX Power（dBm)	TX Power Tolerance（dB)	EVM（dB)
802.11a@6Mbps	15	±2	≦-10
802.11a@54Mbps	15	±2	≦-25
802.11n@HT20_MCS0	15	±2	≦-10
802.11n@HT20_MCS7	15	±2	≦-28
802.11n@HT40_MCS0	14	±2	≦-10
802.11n@HT40_MCS7	14	±2	≦-28
802.11ac@VHT20-MCS8	14	±2	≦-30
802.11ac@VHT40-MCS9	14	±2	≦-32
802.11ac@VHT80_MCS0	14	±2	≦-10
802.11ac@VHT80_MCS9	13	±2	≦-32
802.11ax@HE_SU20_MCS11	13	±2	≦-35
802.11ax@HE_SU40_MCS11	13	±2	≦-35
802.11ax@HE_SU80_MCS11	12	±2	≦-35

5G Receiver Specifications			
RX Rate	Min Input Level（dBm)	Max Input Level（dBm)	PER
802.11a@6Mbps	-95	-2	< 10%
802.11a@54Mbps	-77	-2	< 10%
802.11n@HT20_MCS0	-95	-2	< 10%
802.11n@HT20_MCS7	-76	-2	< 10%

802.11n@HT40_MCS0	-91	-2	< 10%
802.11n@HT40_MCS7	-72	-2	< 10%
802.11ac@VHT20-MCS8	-71	-2	< 10%
802.11ac@VHT40-MCS9	-66	-2	< 10%
802.11ac@VHT80_MCS0	-87	-2	< 10%
802.11ac@VHT80_MCS9	-63	-2	< 10%
802.11ax@HE_SU20_MCS11	-66	-2	< 10%
802.11ax@HE_SU40_MCS11	-63	-2	< 10%
802.11ax@HE_SU80_MCS11	-60	-2	< 10%

4.3 Bluetooth RF Specification

Conditions: VDD33=3.3V; Ta:25℃			
Features	**Description**		
Bluetooth Specification	Bluetooth Core Specification v5.2/4.2/2.1		
Frequency Range	2.4~2.4835GHz (2.4GHz ISM Band)		
Channels	Bluetooth Classic: Ch0~Ch78 (For 1MHz Channels); Bluetooth Low Energy: Ch0~Ch39 (For 2MHz Channels);		
Power Classes	Bluetooth Classic: Class1; Bluetooth Low Energy: Class1.5;		
Date Rate & Modulation	BR_1Mbps: GFSK; EDR_2Mbps: π/4-DQPSK; EDR_3Mbps: 8DPSK; LE_125Kbps: GFSK (Coded_S=8); LE_500Kbps: GFSK (Coded_S=2); LE_1Mbps: GFSK (Uncoded); LE_2Mbps: GFSK (Uncoded);		
Bluetooth Transmitter Specifications			
Items	**Min (dBm)**	**Typ (dBm)**	**Max (dBm)**
TX Power			
BR_1M	0	7	10
EDR_2/3M	0	7	10

LE_125K/500K/1M/2M	0	7	10
Items	**Min**	**Typ**	**Max**
BR_1M (DH1) Modulation Characteristics			
Δf1avg	140KHz	158.6KHz	175KHz
Δf2avg	140KHz	159.7KHz	175KHz
Δf2max	115KHz	162.4KHz	/
Δf2avg/Δf1avg	0.8	1	/
Items	**Min**	**Typ**	**Max**
EDR_3M(3DH5) EDR Carrier Frequency Stability and Modulation Accuracy			
ωi	-75KHz	2.69KHz	+75KHz
ωi+ωo	-75KHz	2.74KHz	+75KHz
ωo	-10KHz	-0.4KHz	+10KHz
8DPSK RMS DEVM	/	0.044	0.13
8DPSK DEVM	/	0.093	0.25
Items	**Min**	**Typ**	**Max**
LE_1M Modulation Characteristics			
Δf1avg	225KHz	249.8KHz	275KHz
Δf2avg	225KHz	239.4KHz	275KHz
Δf2max	185KHz	243.6KHz	/
Δf2avg/Δf1avg	0.8	0.96	/
Items	**Min**	**Typ**	**Max**
LE_2M Modulation Characteristics			
Δf1avg	450KHz	499.64KHz	550KHz
Δf2avg	450KHz	505.55KHz	550KHz
Δf2max	370KHz	498.78KHz	/
Δf2avg/Δf1avg	0.8	1	/

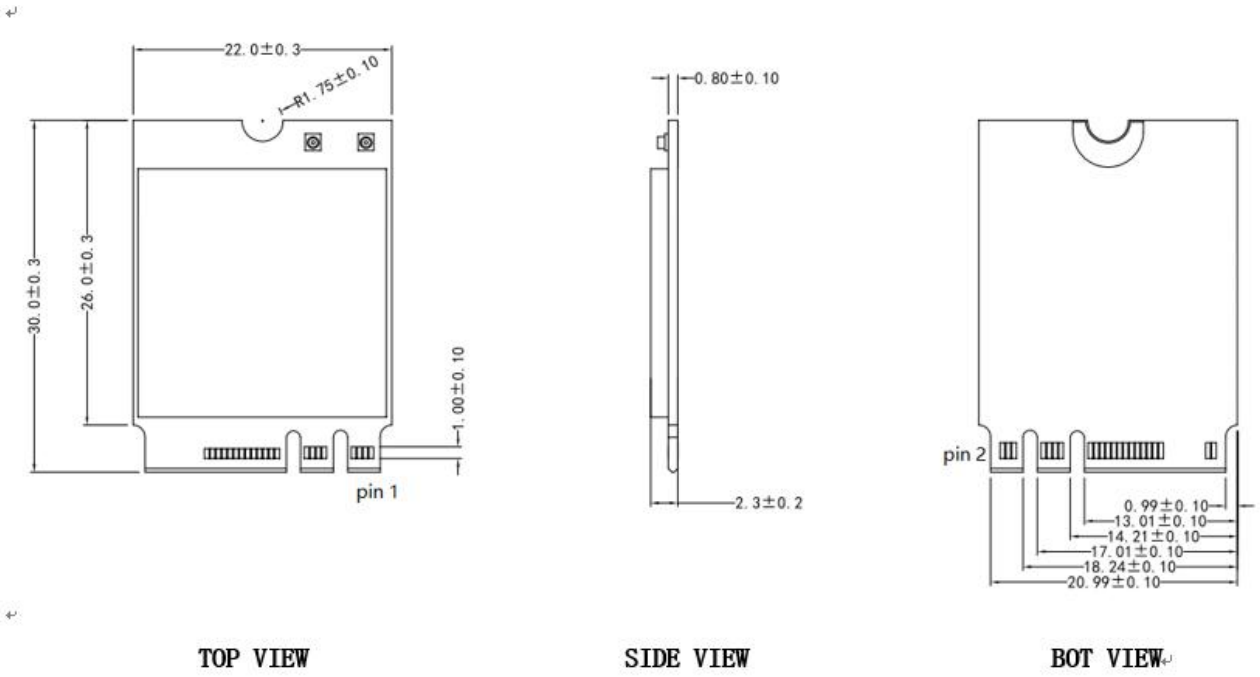
Bluetooth Receiver Specifications

Items	**Sensitivity**		**Maximum Input Level**	
	Input Level(Typ)	**BER**	**Input Level(Typ)**	**BER**

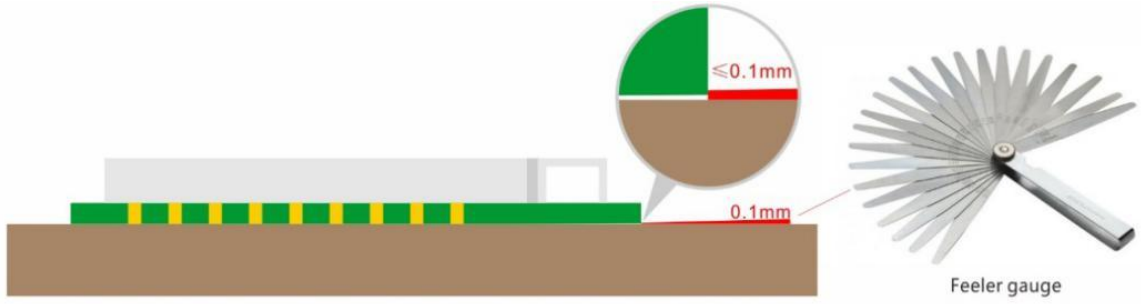
BR_1M (DH1)	-90 dBm	≦ 0.1%	-5 dBm	≦ 0.1%
EDR_3M (3DH5)	-80 dBm	≦ 0.01%	-5 dBm	≦ 0.1%
	Input Level (Typ)	PER	Input Level (Typ)	PER
LE_125K	-92 dBm	≦ 5%	-5 dBm	≦ 5%
LE_1M	-88 dBm	≦ 5%	-5 dBm	≦ 5%
LE_2M	-84 dBm	≦ 5%	-5 dBm	≦ 5%

5. Mechanical Specifications

5.1 Module Outline Drawing



Module dimension: 22*30*2.3m(L*W*H; Tolerance: ±0.15mm)



Module Bow and Twist: ≤0.1mm

5.2 Mechanical Dimensions

TBD

6. Application Information

6.1 Typical Application Circuit

TBD

6.2 HW Application Note

6.2.1 External Antenna Isolation

TBD

6.3 Recommend PCB Layout Footprint

TBD

7. Key Components Of Module

No.	Parts	Specification	Manufacturer	Note
1	Chipset	MT7921LEN	MediaTek	
2	PCB	BL-M7921E-1X, JUI7.820.1088 系列	顺络	
			信利	
			英创力	
3	Crystal	SMD2520-40M	Hosonic	
			TXC	
			加高	
			泰晶	
			晶威特	
			东晶	
4	Diplexer	RFDIP1607ALM9T21	华科	
			佳利	
			ACX	

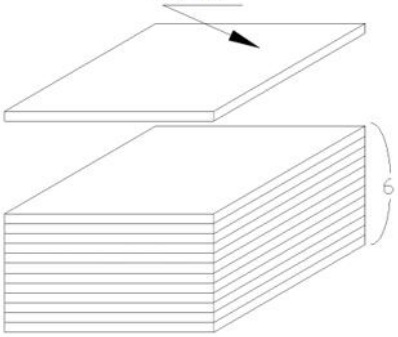
8. Package and Storage Information

8.1 Package Dimensions

产品装入防静电气泡袋

装袋的产品再放入防静电 EPE 衬垫

空托盘



6 盘产品上面放一个盖板，缠绕膜缠绕固定

Package specification:

1. 产品放置方向、标签粘贴位置、包装按示意图进行；
2. 包装内放入 2 包 2g 干燥剂和一张湿度卡；
3. 产品数量每层 20 只，上层放一个空托盘，每箱 120 只/箱;
4. 外箱尺寸：240mm*385mm*140mm;
5. 其它未尽事宜按照客户包装要求执行。

8.2 Storage Conditions

Absolute Maximum Ratings:

Storage temperature: -40℃ to +85℃,

Storage humidity: 10% to 95（Non-Condensing）

Recommended Storage Conditions:

Storage temperature: 5℃ to +40℃,
Storage humidity: 20% to 90% RH

Please use this Module within 12month after vacuum-packaged.
The Module shall be stored without opening the packing.
After the packing opened, the Module shall be used within 72hours.
When the color of the humidity indicator in the packing changed,
The Module shall be baked before soldering.
Baking condition: 60℃, 24hours, 1time.

ESD Sensitivity:
ESD Protection: 2KV(HBM ,Maximum rating)
The Module is a static-sensitive electronic device.
Do not operate or store near strong electrostatic fields.
Take proper ESD precautions!