



BL-M7668BU4

**IEEE 802.11a/b/g/n/ac 2T2R USB WiFi Module
Integrated Bluetooth 2.1+EDR/4.2/5.0**

Features :

3. **Reserving System IEEE**
Std. 802.11a
IEEE Std. 802.11b
IEEE Std. 802.11g
IEEE Std. 802.11n
IEEE Std. 802.11ac Bluetooth
2.1+EDR/4.2/5.0
4. **Chip Solution** Mediatek
MT7668BUN
5. **Size**
33.0mm x70.0mm x 6.0mm



ShenZhen Bilian Electronic Co.,Ltd.

1. Introduction

BL-M7668BU4 module design is based on Mediatek MT7668BUN solution, The MT7668BUN is a highly integrated single chip which has built in a 2x2 dual-band wireless LAN radio and Bluetooth radio. It includes Bluetooth EDR and LE radio which complies with Bluetooth v2.1+EDR, v4.2, and v5.0. The Module is a highly integrated MAC/BBP and 2.4/5GHz PA/LNA single chip which supports a 866.7Mbps PHY rate. The Module is designed to support standard-based features in the areas of security, quality of service, and international regulations, giving end users the greatest performance anytime and in any circumstance. This documentation describes the engineering requirements specification.

• RF module Overview

The general HW architecture for the module is shown in Figure 1. This WLAN Module design is based on Mediatek MT7668BUN. It is a highly integrated single-chip MIMO(Multiple In Multiple Out) Wireless LAN (WLAN) network interface controller complying with the 802.11 specification and Bluetooth over USB interface. It combines a MAC, a 2T2R capable baseband, and RF in a single chip. An intelligent Wi-Fi/Bluetooth coexistence algorithm is implemented to provide the best harmonized Wi-Fi and Bluetooth radio performance.

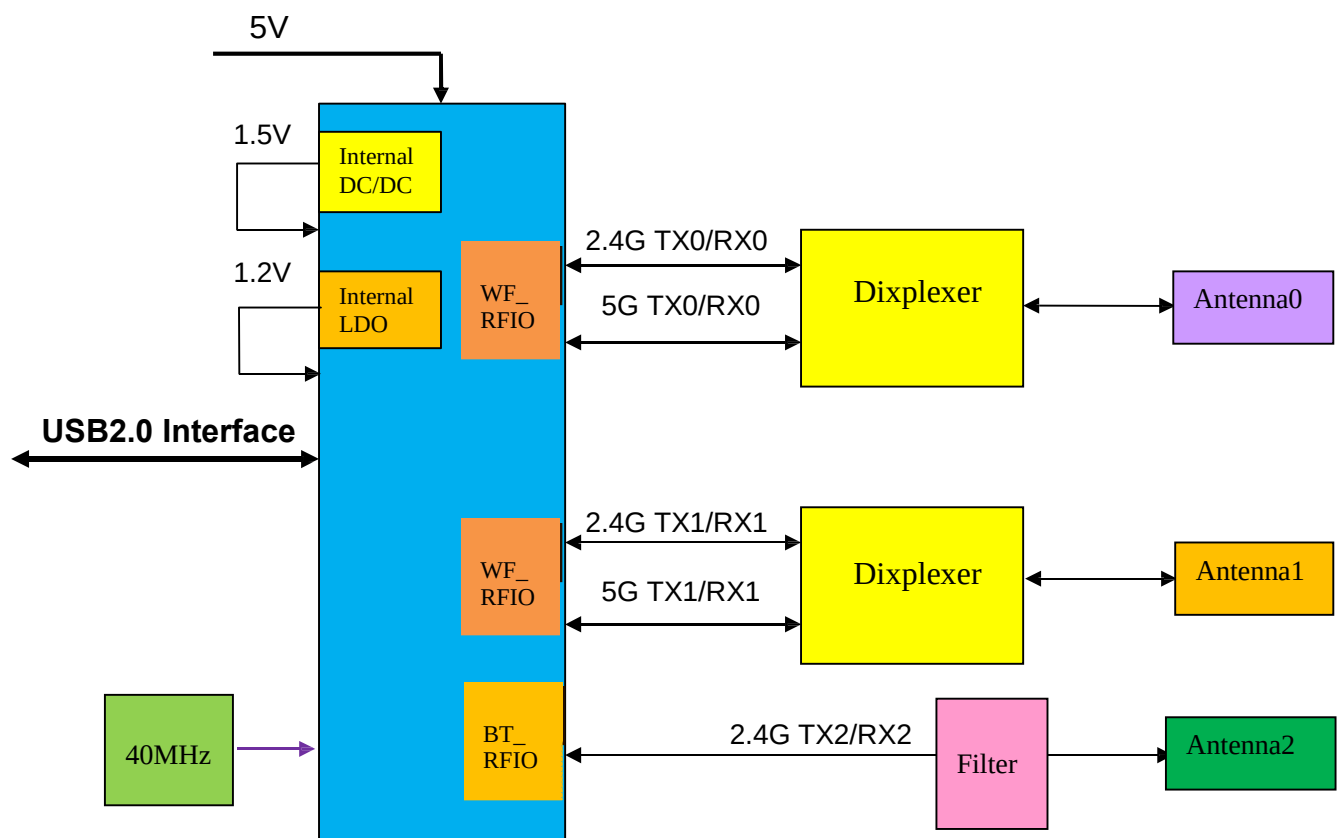


Figure 1 BL-M7668BU4 Block Diagram

- **Specification reference**

This specification is based on additional references listed below.

- _ IEEE Std. 802.11a
- _ IEEE Std. 802.11b
- _ IEEE Std. 802.11g
- _ IEEE Std. 802.11n
- _ IEEE Std. 802.11ac
- _ Bluetooth 2.1+EDR/4.2/5.0

- **System Functions**

Table1: General Specification as below:

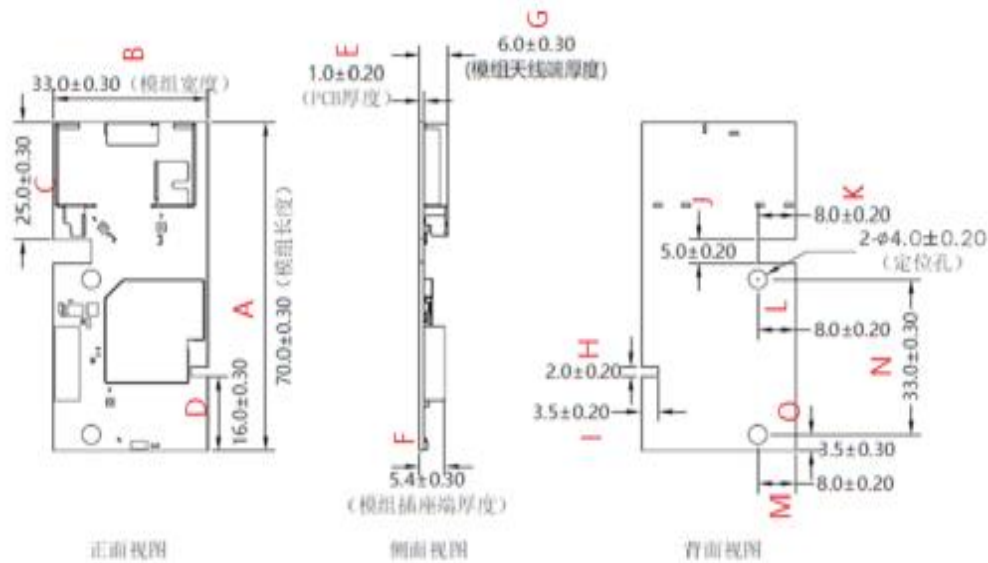
Main Chipset	Mediatek MT7668BUN
Operating Frequency	2.4G/5G
WiFi Standard	802.11a/b/g/n/ac (2x2)
Bluetooth	2.1+EDR/4.2/5.0
Modulation	WIFI:11b: DBPSK, DQPSK and CCK and DSSS 11a/g: BPSK, QPSK, 16QAM, 64QAM and OFDM 11n: BPSK, QPSK, 16QAM, 64QAM and OFDM 11ac: BPSK, QPSK, 16QAM, 64QAM, 256QAM and OFDM Bluetooth: GFSK, $\pi/4$ -DQPSK and 8-DPSK
Data rates	11b: 1, 2, 5.5 and 11Mbps 11a/g: 6, 9, 12, 18, 24, 36, 48 and 54 Mbps 11n: MCS0~15, up to 300Mbps 11ac: MCS0~9, Nss=2, up to 866.7Mbps
Form factor	10pins ,
Host Interface	USB 2.0
PCB Stack	4-layers design
Dimension	Typical, 33mm x 70mm x 6.0mm
Antenna	Internal Antennas Design
Operation Temperature	-20℃ to +70℃
Storage Temperature	-40℃ to +125℃
Operation Voltage	5V +/-5%

2. Mechanical Specification

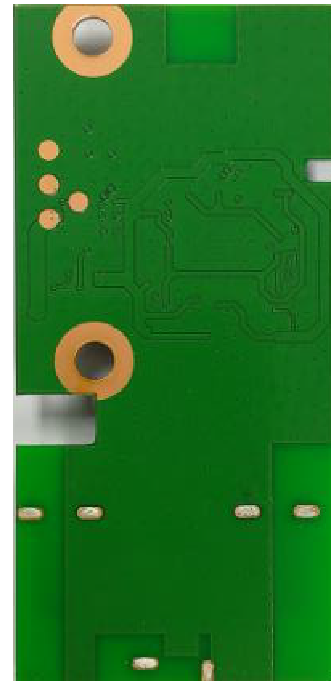
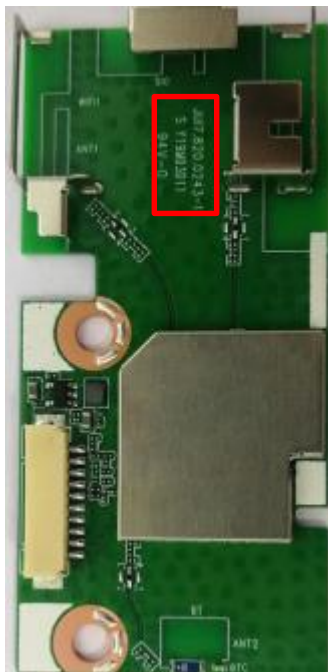
• Mechanical Outline Drawing

Typical Dimension (W x L): 33.0mmx 70.0mm x 6.0mm

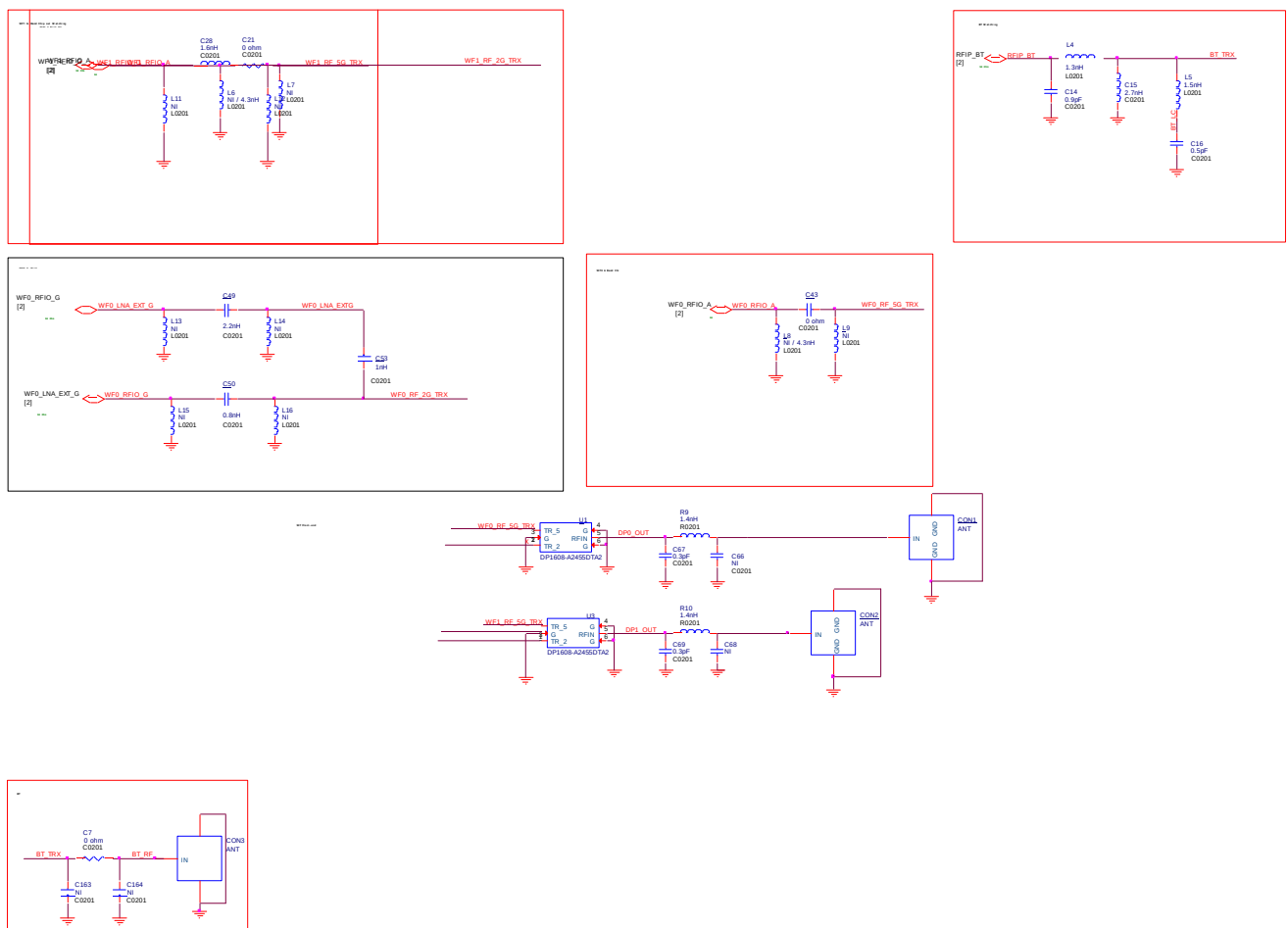
General tolerance: $\pm 0.3\text{mm}$



• Product Picture



- SCH





> Electrical Specification

This Specification is based-on conductive DVT testing result. The extreme condition include overall temperature (0°C,+25°C,+40°C) and overall voltage (4.75V,5V,5.25V).

• IEEE 802.11b Section:

Items	Contents				
Specification	IEEE802.11b				
Mode	DBPSK, DQPSK and CCK and DSSS				
Channel	CH1 to CH13				
Data rate	1, 2, 5.5, 11Mbps				
TX Characteristics	Min.	Typ.	Max.	Unit	Remar
1. Power Levels(Calibrated)					
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	-	-20	-10	dB	
4. Frequency Error	-15	-	15	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
5. Minimum Input Level Sensitivity(each chain)					
1) 1Mbps (FER $\leq$ 8%)	-		-83	dBm	
2) 2Mbps (FER $\leq$ 8%)	-		-80	dBm	
3) 5.5Mbps (FER $\leq$ 8%)	-		-79	dBm	
4) 11Mbps (FER $\leq$ 8%)	-		-76	dBm	
6. Maximum Input Level (FER $\leq$ 8%)	-10	-	-	dBm	

• **IEEE 802.11g/a Section:**

Items	Contents				
Specification	IEEE802.11g & IEEE802.11a				
Mode	BPSK, QPSK, 16QAM, 64QAM and OFDM				
Channel	CH1 to CH13 @ 11g CH36 to CH165				
Data rate	6, 9, 12, 18, 24, 36, 48, 54Mbps				
TX Characteristics	Min.	Typ.	Max.	Unit	Remar
1. Power Levels					
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					
1) IEEE802.11g	-15	-	15	ppm	
2) IEEE802.11a	-15		15	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%)					
1) IEEE802.11g	-20	-	-	dBm	
2) IEEE802.11a	-30			dBm	

• **IEEE 802.11n HT20 Section:**

Items	Contents				
Specification	IEEE802.11n HT20 @ 2.4G IEEE802.11n				
Mode	BPSK, QPSK, 16QAM, 64QAM and OFDM				
Channel	CH1 to CH13 @ 2.4G CH36 to				
Data rate (MCS index)	MCS0/1/2/3/4/5/6/7/8/9/10/11/12/13/14/15				
TX Characteristics	Min.	Typ.	Max.	Unit	Remark
1. Power Levels					
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					
1) IEEE802.11n HT20 @ 2.4G	-15	-	15	ppm	
2) IEEE802.11n HT20 @ 5G	-15	-	15	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	
6. Maximum Input Level (PER $\leq 10\%$)					
1) IEEE802.11n HT20 @ 2.4G	-20	-	-	dBm	
2) IEEE802.11n HT20 @ 5G	-30	-	-	dBm	

• **IEEE 802.11n HT40 Section:**

Items	Contents				
Specification	IEEE802.11n HT20 @ 2.4G IEEE802.11n				
Mode	BPSK, QPSK, 16QAM, 64QAM and OFDM				
Channel	CH3 to CH11 @ 2.4G CH38 to				
Data rate (MCS index)	MCS0/1/2/3/4/5/6/7/8/9/10/11/12/13/14/15				
TX Characteristics	Min.	Typ.	Max.	Unit	Remar
1. Power Levels (Calibrated)					
2. Spectrum Mask @ Target Power					
1) at fc +/-21MHz	-	-	-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					
1) IEEE802.11n HT20 @ 2.4G	-15	-	15	ppm	
2) IEEE802.11n HT20 @ 5G	-15	-	15	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
5. Minimum Input Level Sensitivity(each chain)					
1) MCS0 (PER $\leq$ 10%)	-	-	-79	dBm	
2) MCS1 (PER $\leq$ 10%)	-	-	-76	dBm	
3) MCS2 (PER $\leq$ 10%)	-	-	-74	dBm	
4) MCS3 (PER $\leq$ 10%)	-	-	-71	dBm	
5) MCS4 (PER $\leq$ 10%)	-	-	-67	dBm	
6) MCS5 (PER $\leq$ 10%)	-	-	-63	dBm	
7) MCS6 (PER $\leq$ 10%)	-	-	-62	dBm	
8) MCS7 (PER $\leq$ 10%)	-	-	-61	dBm	
6. Maximum Input Level(PER $\leq$ 10%)					
1) IEEE802.11n HT20 @ 2.4G	-20	-	-	dBm	
2) IEEE802.11n HT20 @ 5G	-30	-	-	dBm	

• **IEEE 802.11ac Section:**

Items	Contents					
Specification	IEEE802.11ac					
Mode	BPSK, QPSK, 16QAM, 64QAM ,256QAM and OFDM					
Channel	CH36 to CH165 VHT20 CH38 to CH163 VHT40 CH42					
Data rate (MCS index)	MCS0/1/2/3/4/5/6/7/8/9					
TX Characteristics	Min.	Typ.	Max.			Uni Remar
1. Power Levels (Calibrated)						
2. Spectrum Mask @ Target Power						
1) at fc +/-11MHz /20MHz/30MHz	-	-	-20			dB
2) at fc +/-21MHz /40MHz/60MHz	-	-	-28			dB
3) at fc +/-41MHz /80MHz/120MHz	-	-	-40			dB
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	-15	-	15			pp
RX Characteristics	Min.	Typ.	Max.			Uni
5. Minimum Input Level Sensitivity(each			VHT2	VHT4	VHT8	
1) MCS0 (PER $\leq 10\%$)	-	-	-82	-79	-76	dB
2) MCS1 (PER $\leq 10\%$)	-	-	-79	-76	-73	dB
3) MCS2 (PER $\leq 10\%$)	-	-	-77	-74	-71	dB
4) MCS3 (PER $\leq 10\%$)	-	-	-74	-71	-68	dB
5) MCS4 (PER $\leq 10\%$)	-	-	-70	-67	-64	dB
6) MCS5 (PER $\leq 10\%$)	-	-	-66	-63	-60	dB
7) MCS6 (PER $\leq 10\%$)	-	-	-65	-62	-59	dB
8) MCS7 (PER $\leq 10\%$)	-	-	-64	-61	-58	dB
9) MCS8 (PER $\leq 10\%$)	-	-	-59	-56	-53	dB
10) MCS9 (PER $\leq 10\%$)	-	-	-57	-54	-51	dB
6. Maximum Input Level(PER $\leq 10\%$)	-30	-	-			dB

- Bluetooth Section:**

3.6.1BR Specification

Items	Contents				
Host Interface	USB				
Antenna Reference	Small antennas with 0~2 dBi peak gain				
Channel	CH0 to CH78				
Modulation	GFSK				
	Min.	Typ.	Max.	Unit	
TX Characteristics					
2.Modulation Characteristics					
1)Delta f1(Avg)		157		kHz	
2)Delta f2max(For at least 99.9% of all Delta f2max)		121		kHz	
3)Delta f2/ Delta f1		0.85		kHz	
3.Initial Carrier Frequency Tolerance		+/-20	-	kHz	
4. Carrier Frequency Drift					
1) One Slot packet drift (DH1)		+/-15		kHz	
2) Three Slot packet drift (DH3)		+/-15		kHz	
3) Five Slot packet drift (DH5)		+/-15		kHz	
4) Max Drift Rate		+/-15		kHz/50u	
RX Characteristics					
1. Receiver Sensitivity (BER<0.1%)		-92		dBm	
2. Maximum usable signal (BER<0.1%)		-5		dBm	

3.6.2 EDR Specification

Items	Contents				
Host Interface	USB				
Antenna Reference	Small antennas with 0~2 dBi peak gain				
Channel	CH0 to CH78				
Modulation	$\pi/4$ -DQPSK 、 8PSK				
	Min.	Typ.	Max.	Unit	
TX Characteristics					
1) $\pi/4$ -DQPSK					
2) 8PSK					
2. Frequency Stability				kHz	
1) Omega-i		+/-4		kHz	
2) Omega-0		+/-4	-	kHz	
3) Omega-0 + Omega-i		+/-4			
3. Modulation Accuracy					
1) RMS DEVM					
$\pi/4$ -DQPSK		+/-9		%	
8PSK		+/-9		%	
2) Peak DEVM					
$\pi/4$ -DQPSK		+/-28		%	
8PSK		+/-21		%	
3) 99% DEVM					
$\pi/4$ -DQPSK		+/-15		%	
8PSK		+/-12		%	
RX Characteristics					
1. Receiver Sensitivity (BER<0.01%)					
1) $\pi/4$ -DQPSK		-91		dBm	
2) 8PSK		-85		dBm	
2. Maximum usable signal (BER<0.1%)					
1) $\pi/4$ -DQPSK		-5		dBm	
2) 8PSK		-5		dBm	

3.6.3 LE Specification

Items	Contents				
Host Interface	USB				
Antenna Reference	Small antennas with 0~2 dBi peak gain				
Channel	CH0 to CH39				
	Min.	Typ.	Max.	Unit	
TX Characteristics					
1. Output power at NOC		4		dBm	
2. Modulation Characteristics					
1)Delta f1(Avg)	225		275	kHz	
2)Delta f2max(For at least 99.9% of all Delta f2max)	185			kHz	
3)Delta f2/ Delta f1	0.8	0.94		Hz/Hz	
3. Carrier frequency offset and drift					
1) Frequency Offset	-150		150	kHz	
2) Frequency Drift	-50		50	kHz	
3) Max Drift Rate	-20		20	Hz/us	
4.In-band Spurious Emissions					
1)/+-2M offset			20	dBm	
2)>+-3MHz offset			30	dBm	
RX Characteristics					
1. Receiver Sensitivity (BER<30.8%)		-95		dBm	
2. Maximum usable signal (BER<30.8%)		-5		dBm	

➤ Current consumption

• WLAN current consumption

Description	Average current (mA)
Sleep mode, radio off	1.5
2.4GHz RX power saving, DTIM=1	3.3
2.4GHz RX active, HT20, MCS15	144
2.4GHz TX CCK, 11Mbps@21dBm	403
2.4GHz TX HT20, MCS15 @17.5dBm	496
2.4GHz TX HT20, MCS8 @18dBm	520
5GHz VHT80 RX listen, 2RX	154
5GHz RX active, VHT80, MCS9, Nss=2	242
5GHz TX VHT80, MCS9, Nss=2 @ 15dBm	678
5GHz TX VHT80, MCS0, Nss=2 @ 16.5dBm	713

• Bluetooth current consumption

Description	Average current (mA)
Sleep mode, radio off	1.5
Bluetooth TX@9dBm	42
Bluetooth RX	21
Bluetooth SCO connection, HV3 packets + sniff mode + scan (page scan interval=1.28sec, inquiry	21
Bluetooth page scan + inquiry scan ((page scan interval=1.28sec, inquiry scan interval=2.56s)	1.7
Bluetooth page scan (page scan interval=1.28sec)	1.6

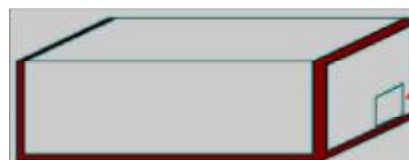
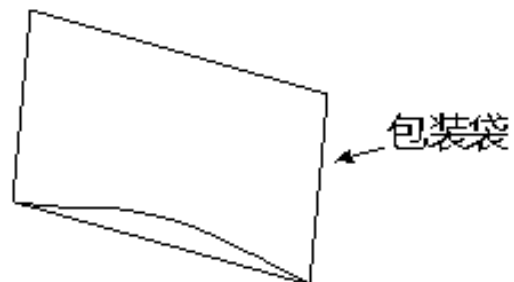
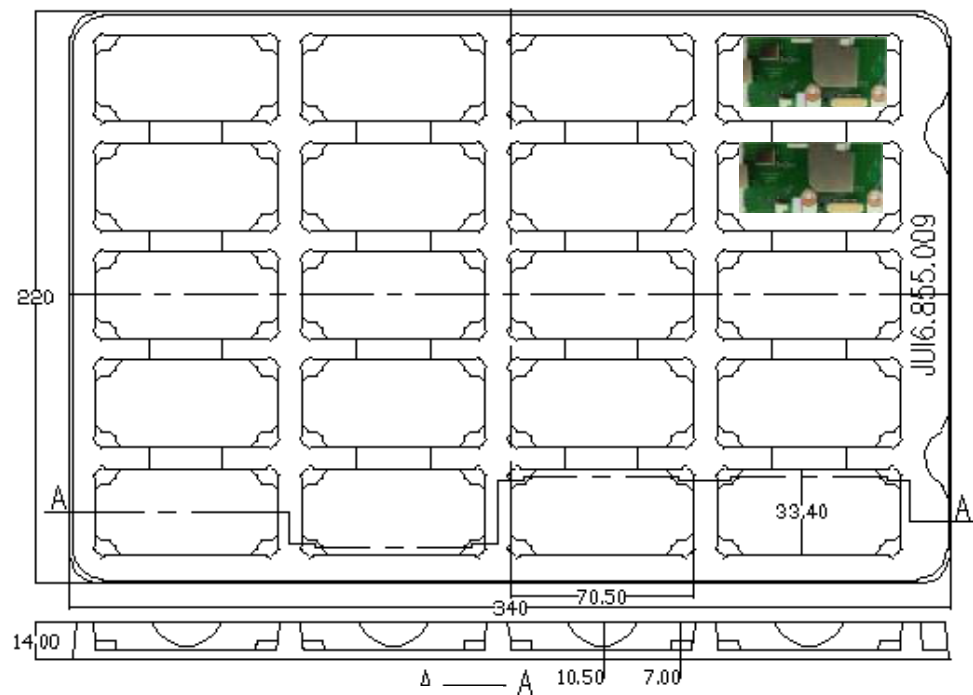
Note:

- 1、 All result is measured provided VDD33 is 3.3V. Tx power is measured at antenna port. Temperature is 25°C.
- 2、 Host interface is USB2.0
- 3、 Duty cycle for TX/RX measurement is 100%
- 4、 The chip variation is +/-15%

➤ Software Requirements

The driver supports the following operating systems: Linux, Microsoft Windows XP, Vista and Win7.
Mfg. software tool is MT7668BUN_QA_Tool.

➤ Key component List

>Packaging Information:

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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: 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 important announcement

Important Note:

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 0cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Country Code selection feature to be disabled for products marketed to the US/Canada.

This device is intended only for OEM integrators under the following conditions:

1. The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2. The transmitter module may not be co-located with any other transmitter or antenna,
3. For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change. (if modular only test Channel 1-11)

As long as the three conditions above are met, further transmitter testing 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 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.

End Product Labeling

The final end product must be labeled in a visible area with the following" Contains FCC ID: **2AL6KBL-M7668BU4**"

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.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

2.2 List of applicable FCC rules

CFR 47 FCC PART 15 SUBPART C has been investigated. It is applicable to the modular transmitter

2.3 Specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

2.4 Limited module procedures

Not applicable

2.5 Trace antenna designs

Not applicable

2.6 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.

2.7 Antennas

This radio transmitter **2AL6KBL-M7668BU4** has been approved by Federal Communications Commission 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.

Model	Type	Connector	Peak gain (dBi)				
			2400-2483.5 MHz	5150-5250 MHz	5250-5350 MHz	5470-5725 MHz	5725-5850 MHz
2400-2483.5 MHz	External Antenna	/	1.0dBi for BT 2.0dBi for WLAN	/	/	/	/
5000-5900 MHz	External Antenna	/	/	2.0dBi	/	/	2.0dBi

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following" Contains FCC ID:2AL6KBL-M7668BU4".

2.9 Information on test modes and additional testing requirements

Host manufacturer is strongly recommended to confirm compliance with FCC requirements for the transmitter when the module is installed in the host.

2.10 Additional testing, Part 15 Subpart B disclaimer

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B.