User Manual for WF-M63B-USH1

1. Introduction

WF-M63B-USH1 module design is based on Mediatek MT7663BUN solution, The MT7663BUN 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 v5.1. 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.

1.1 RF module Overview

The general HW architecture for the module is shown in Figure 1. This WLAN Module design is based on Mediatek MT7663BUN. 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.

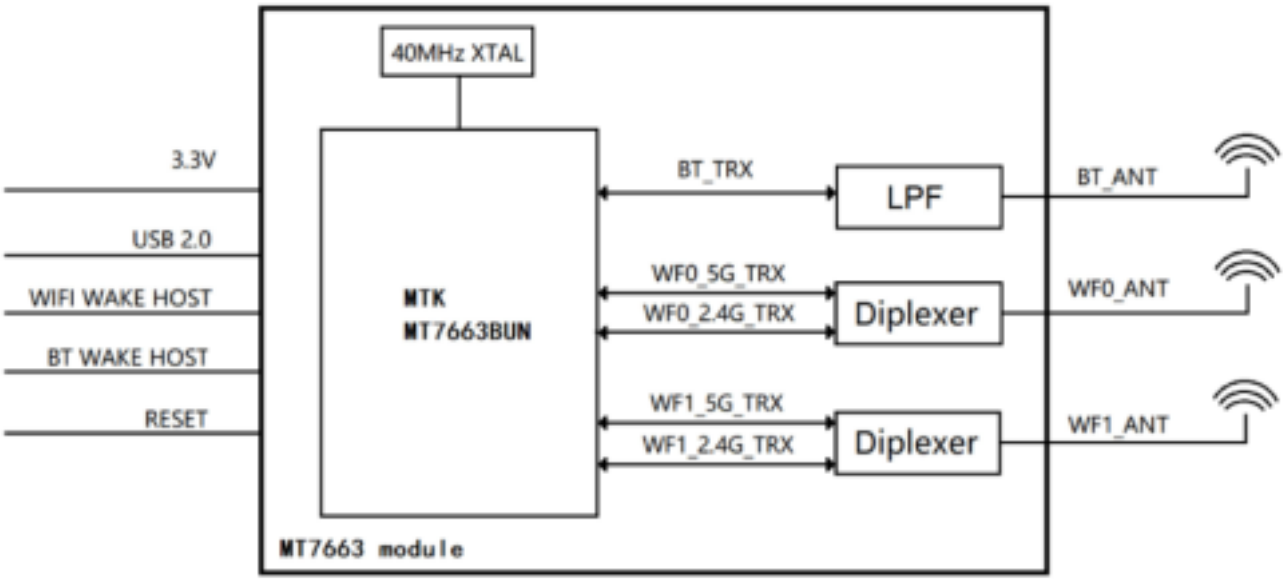


Figure 1 WF-M63B-USH1 Block Diagram

1.2 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/4.2/5.1

1.3 System Functions

Table1: General Specification as below:

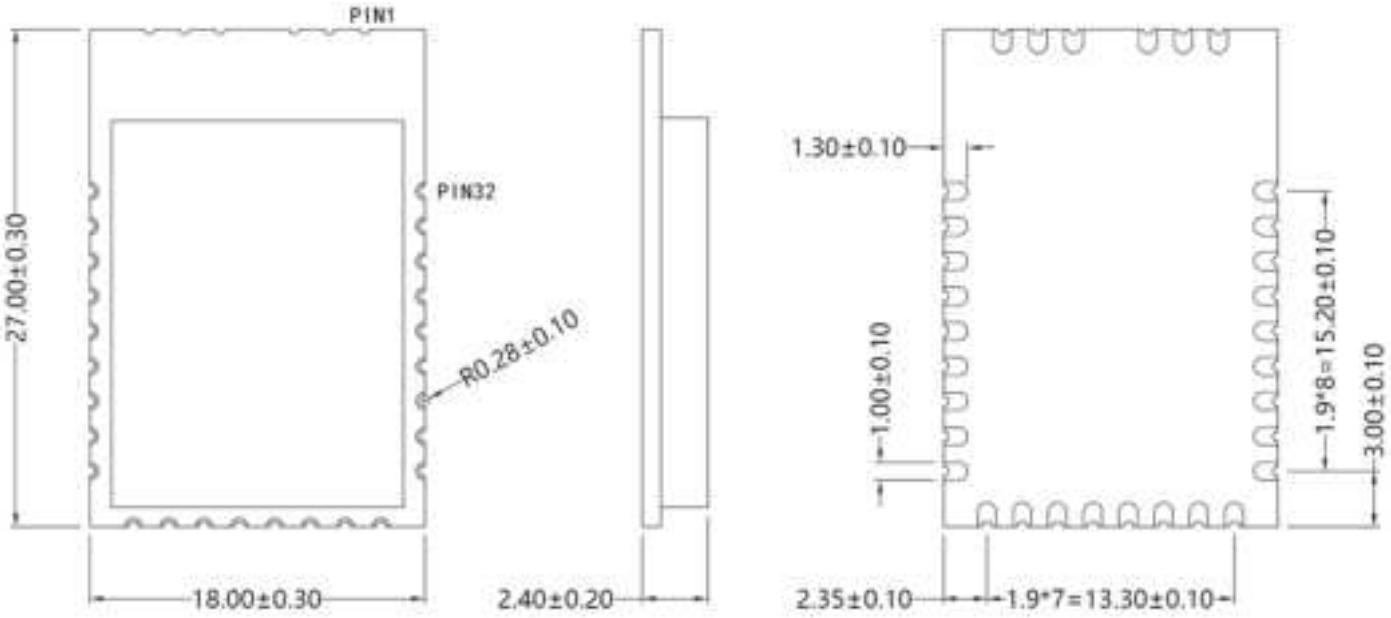
Main Chipset	Mediatek MT7663BUN
Operating Frequency	2.4G/5G
WiFi Standard	802.11a/b/g/n/ac (2x2)
Bluetooth	2.1+EDR/4.2/5.1
Modulation	WIFI:11b: DBPSK, DQPSK and CCK and DSSS 11a/g: BPSK, QPSK, 16QAM, 64QAM and OFDM 11n: BPSK, QPSK, 16QAM, 64QAM and OFDM 11ac: BPSK, QPSK, 16QAM, 64QAM,256QAM and OFDM Bluetooth: GFSK, π/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	32pins
Host Interface	USB 2.0
PCB Stack	4-layers design
Dimension	Typical: 18mm x 27mm x 2.4mm
Antenna	external Antennas Design
Operation Temperature	-10℃ to +70℃
Storage Temperature	-40℃ to +85℃
Operation Voltage	3.3V +/-5%
Power Consumption（WIFI TX）	813mA@3.3V 5G TX NSS=2 HT20 MCS0
Power Consumption（WIFI RX）	165mA@3.3V 5G RX NSS=2 VHT80 MCS9
Power Consumption（BT TX）	82mA@3.3V
Power Consumption（BT RX）	29mA@3.3V

2. Mechanical Specification

2.1 Mechanical Outline Drawing

Typical Dimension (W x L x H): 27.0mmx18.00mm x 2.4mm

General tolerance: ±0.2mm



TOP View **SIDE View** **BOT View**

2.2 Product Picture

Top view

Bot view

2.3 Pin define

NO	Definition	Descriptions
1	GND	Ground
2	WIFI1	WIFI1
3	GND	Ground
4	GND	Ground
5	WIFI0	WIFI0
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	WOW	Wi-Fi device wake up host
10	RST	Internal regulator on/off
11	RST	Internal regulator on/off
12	GND	Ground
13	3.3V	+3.3V Voltage power
14	NC	NC
15	GND	Ground
16	NC	NC
17	NC	NC
18	NC	NC
19	NC	NC
20	GND	Ground
21	DP+	USB interface
22	DM-	USB interface
23	GND	Ground
24	NC	NC
25	GPIO3	Debug UART TXD
26	GND	Ground
27	BT RF	BT RF PIN
28	GND	Ground
29	BT_Wake_host	BT device wake up host
30	NC	NC
31	NC	NC
32	NC	NC

3. Electrical Specification

This Specification is based-on conductive DVT testing result. The extreme condition include overall temperature (0℃,+25℃,+40℃) and overall voltage (2.97V,3.3V,3.63V).

3.1 IEEE 802.11b Section:

Items	Contents				
Specification	IEEE802.11b				
Mode	DBPSK, DQPSK and CCK and DSSS				
Channel	CH1 to CH11				
Data rate	1, 2, 5.5, 11Mbps				
TX Characteristics	Min.	Typ.	Max.	Unit	Remark
1. Spectrum Mask @ Target Power					
1) fc +/-11MHz to +/-22MHz	-	-	-30	dBr	
2) fc > +/-22MHz	-	-	-50	dBr	
2. Constellation Error(EVM) @ Target Power					
1) 1Mbps	-	-23	-13	dB	
2) 2Mbps	-	-	-13	dB	
3) 5.5Mbps	-	-	-13	dB	
4) 11Mbps	-	-23	-13	dB	
3. Frequency Error	-10	-	10	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
4. Minimum Input Level Sensitivity(each chain)					
1) 1Mbps (FER ≦8%)	-	-95	-85	dBm	
2) 2Mbps (FER ≦8%)	-	-	-83	dBm	
3) 5.5Mbps (FER ≦8%)	-	-	-81	dBm	
4) 11Mbps (FER ≦8%)	-	-89	-79	dBm	
5. Maximum Input Level (FER ≦8%)	-10	10	-	dBm	

3. 2 IEEE 802.11g/a Section:

Items	Contents				
Specification	IEEE802.11g & IEEE802.11a				
Mode	BPSK, QPSK, 16QAM, 64QAM and OFDM				
Channel	CH1 to CH11 @ 11g CH36 to CH48, CH149 to CH165 @ 11a				
Data rate	6, 9, 12, 18, 24, 36, 48, 54Mbps				
TX Characteristics	Min.	Typ.	Max.	Unit	Remark
1. Spectrum Mask @ Target Power					
1) at fc +/-11MHz	-	-	-20	dBr	
2) at fc +/-20MHz	-	-	-28	dBr	
3) at fc > +/-30MHz	-	-	-40	dBr	
2. Constellation Error(EVM) @ Target Power					
1) 6Mbps	-	-30	-8	dB	
2) 9Mbps	-	-	-11	dB	
3) 12Mbps	-	-	-13	dB	
4) 18Mbps	-	-	-16	dB	
5) 24Mbps	-	-	-19	dB	
6) 36Mbps	-	-	-23	dB	
7) 48Mbps	-	-	-25	dB	
8) 54Mbps	-	-37	-28	dB	
3. Frequency Error					
1) IEEE802.11g	-10	-	10	ppm	
2) IEEE802.11a	-10		10	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
4. Minimum Input Level Sensitivity(each chain)					
1) 6Mbps (PER ≦10%)	-	-94	-85	dBm	
2) 9Mbps (PER ≦10%)	-	-	-84	dBm	
3) 12Mbps (PER ≦10%)	-	-	-82	dBm	
4) 18Mbps (PER ≦10%)	-	-	-80	dBm	
5) 24Mbps (PER ≦10%)	-	-	-77	dBm	
6) 36Mbps (PER ≦10%)	-	-	-73	dBm	
7) 48Mbps (PER ≦10%)	-	-	-69	dBm	
8) 54Mbps (PER ≦10%)	-	-76	-68	dBm	
5. Maximum Input Level (PER ≦10%)					
1) IEEE802.11g	-20	-2	-	dBm	
2) IEEE802.11a	-30	-2		dBm	

3.3 IEEE 802.11n HT20 Section:

Items	Contents				
Specification	IEEE802.11n HT20 @ 2.4G IEEE802.11n HT20 @ 5G				
Mode	BPSK, QPSK, 16QAM, 64QAM and OFDM				
Channel	CH1 to CH11 @ 2.4G CH36 to CH48, CH149 to CH165 @ 5G				
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. Spectrum Mask @ Target Power					
1) at fc +/-11MHz	-	-	-20	dBr	
2) at fc +/-20MHz	-	-	-28	dBr	
3) at fc > +/-30MHz	-	-	-45	dBr	
2. Constellation Error(EVM) @ Target Power					
1) MCS0	-	-30	-8	dB	
2) MCS1	-	-	-13	dB	
3) MCS2	-	-	-16	dB	
4) MCS3	-	-	-19	dB	
5) MCS4	-	-	-22	dB	
6) MCS5	-	-	-25	dB	
7) MCS6	-	-	-28	dB	
8) MCS7	-	-38	-30	dB	
3. Frequency Error					
1) IEEE802.11n HT20 @ 2.4G	-10	-	10	ppm	
2) IEEE802.11n HT20 @ 5G	-10	-	10	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
4. Minimum Input Level Sensitivity(each chain)					
1) MCS0 (PER ≦10%)	-	-94	-85	dBm	
2) MCS1 (PER ≦10%)	-	-	-82	dBm	
3) MCS2 (PER ≦10%)	-	-	-80	dBm	
4) MCS3 (PER ≦10%)	-	-	-77	dBm	
5) MCS4 (PER ≦10%)	-	-	-73	dBm	
6) MCS5 (PER ≦10%)	-	-	-69	dBm	
7) MCS6 (PER ≦10%)	-	-	-68	dBm	
8) MCS7 (PER ≦10%)	-	-74	-67	dBm	
5. Maximum Input Level (PER ≦10%)					
1) IEEE802.11n HT20 @ 2.4G	-20	-2	-	dBm	
2) IEEE802.11n HT20 @ 5G	-30	-2	-	dBm	

3.4 IEEE 802.11n HT40 Section:

Items	Contents				
Specification	IEEE802.11n HT40 @ 2.4G IEEE802.11n HT40 @ 5G				
Mode	BPSK, QPSK, 16QAM, 64QAM and OFDM				
Channel	CH3 to CH9 @ 2.4G CH38 to CH46, CH151 to CH159 @ 5G				
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. Spectrum Mask @ Target Power					
1) at fc +/-21MHz	-	-	-20	dBr	
2) at fc +/-40MHz	-	-	-28	dBr	
3) at fc > +/-60MHz	-	-	-45	dBr	
2. Constellation Error(EVM) @ Target Power					
1) MCS0	-	-30	-8	dB	
2) MCS1	-	-	-13	dB	
3) MCS2	-	-	-16	dB	
4) MCS3	-	-	-19	dB	
5) MCS4	-	-	-22	dB	
6) MCS5	-	-	-25	dB	
7) MCS6	-	-	-28	dB	
8) MCS7	-	-38	-30	dB	
3. Frequency Error					
1) IEEE802.11n HT20 @ 2.4G	-10	-	10	ppm	
2) IEEE802.11n HT20 @ 5G	-10	-	10	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
4. Minimum Input Level Sensitivity(each chain)					
1) MCS0 (PER ≦10%)	-	-90	-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%)	-	-71	-64	dBm	
5. Maximum Input Level(PER ≦10%)					
1) IEEE802.11n HT20 @ 2.4G	-20	-2	-	dBm	
2) IEEE802.11n HT20 @ 5G	-30	-2	-	dBm	

3.5 IEEE 802.11ac Section:

Items	Contents								
Specification	IEEE802.11ac								
Mode	BPSK, QPSK, 16QAM, 64QAM ,256QAM and OFDM								
Channel	CH36 to CH48, CH149 to CH165 VHT20 CH38 to CH46, CH151 to CH159 VHT40 CH42, CH155 VHT80								
Data rate (MCS index)	MCS0/1/2/3/4/5/6/7/8/9								
TX Characteristics	Min.	Typ.			Max.			Unit	Remark
1. Spectrum Mask @ Target Power									
1) at fc +/-11MHz /20MHz/30MHz	-	-			-20			dBr	
2) at fc +/-21MHz /40MHz/60MHz	-	-			-28			dBr	
3) at fc +/-41MHz /80MHz/120MHz	-	-			-40			dBr	
2. Constellation Error(EVM) @ Target Power									
1) MCS0	-	-			-8			dB	
2) MCS1	-	-			-13			dB	
3) MCS2	-	-			-16			dB	
4) MCS3	-	-			-19			dB	
5) MCS4	-	-			-22			dB	
6) MCS5	-	-			-25			dB	
7) MCS6	-	-			-28			dB	
8) MCS7	-	-			-30			dB	
9) MCS8					-32			dB	
10) MCS9		-36			-33			dB	
3. Frequency Error	-10	-			10			ppm	
RX Characteristics	Min.	Typ.			Max.			Unit	
4. Minimum Input Level Sensitivity(each chain)		VHT 20	VHT 40	VHT 80	VHT 20	VHT 40	VHT 80		
1) MCS0 (PER ≦10%)	-	-94	-90	-87	-85	-82	-79	dBm	
2) MCS1 (PER ≦10%)	-	-	-	-	-82	-79	-76	dBm	
3) MCS2 (PER ≦10%)	-	-	-	-	-80	-77	-74	dBm	
4) MCS3 (PER ≦10%)	-	-	-	-	-77	-74	-71	dBm	
5) MCS4 (PER ≦10%)	-	-	-	-	-73	-70	-67	dBm	
6) MCS5 (PER ≦10%)	-	-	-	-	-69	-67	-63	dBm	
7) MCS6 (PER ≦10%)	-	-	-	-	-68	-65	-62	dBm	
8) MCS7 (PER ≦10%)	-	-	-	-	-67	-64	-61	dBm	
9) MCS8 (PER ≦10%)	-	-	-	-	-62	-59	-56	dBm	
10) MCS9 (PER ≦10%)	-	-70	-65	-63	-60	-57	-54	dBm	
5. Maximum Input Level(PER ≦10%)	-30	-2	-2	-2	-			dBm	

3.6 Bluetooth Section:

3.6.1 BR Specification

Items	Contents				
Host Interface	USB				
Channel	CH0 to CH78				
Modulation	GFSK				
	Min.	Typ.	Max.	Unit	
TX Characteristics					
1.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	
2.Initial Carrier Frequency Tolerance		+/-20	-	kHz	
3. 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/50us	
RX Characteristics					
1. Receiver Sensitivity (BER<0.1%)		-94		dBm	
2. Maximum usable signal (BER<0.1%)		-5		dBm	

3.6.2 EDR Specification

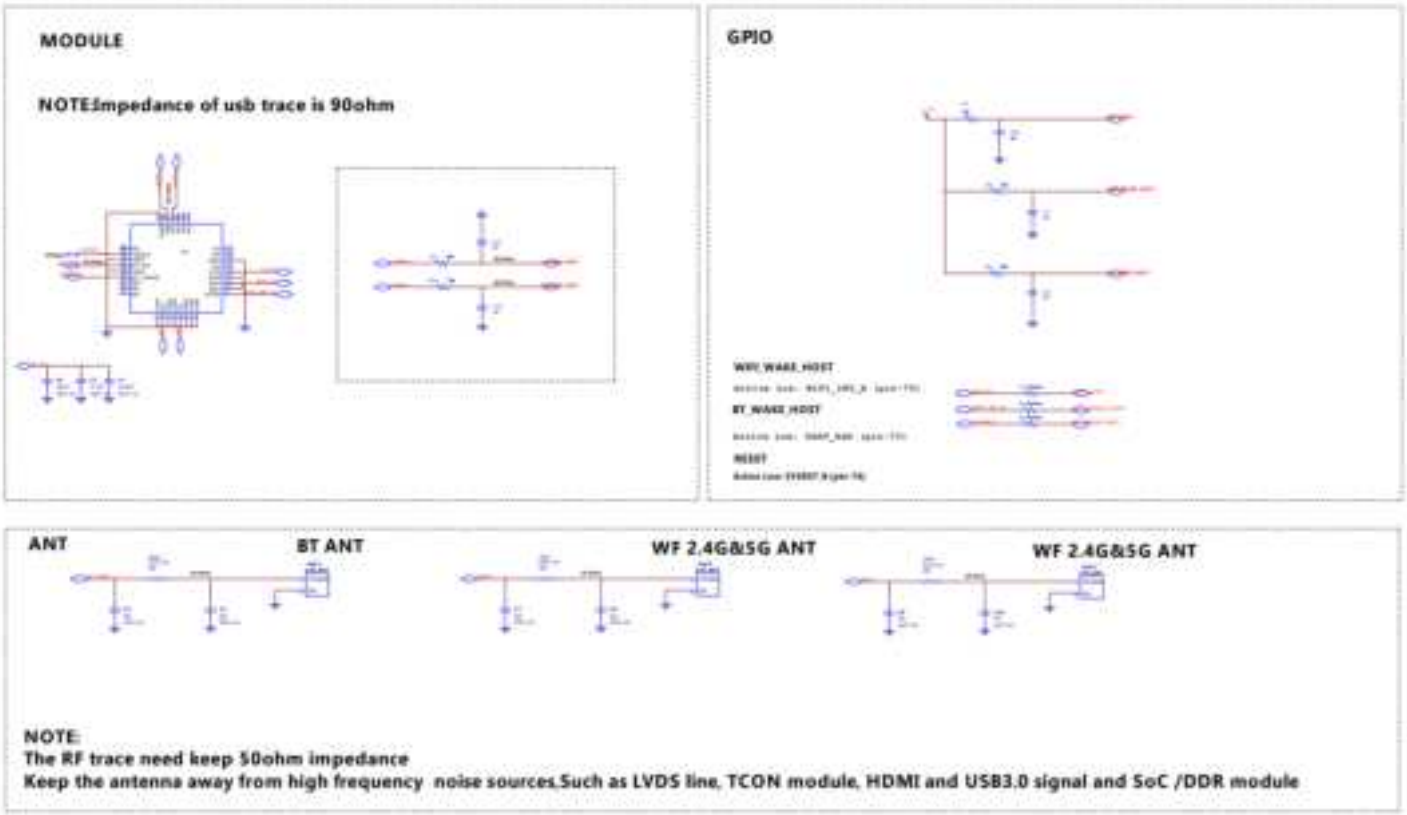
Items	Contents				
Host Interface	USB				
Channel	CH0 to CH78				
Modulation	π/4-DQPSK 、8PSK				
	Min.	Typ.	Max.	Unit	
TX Characteristics	6	10	14		
1. Frequency Stability				kHz	
1) Omega-i		+/-4		kHz	
2) Omega-0		+/-4	-	kHz	
3) Omega-0 + Omega-i		+/-4			
2. Modulation Accuracy					
1) RMS DEVM					
π/4-DQPSK		+/-9		%	
8PSK		+/-9		%	
2) Peak DEVM					
π/4-DQPSK		+/-28		%	
8PSK		+/-21		%	
3) 99% DEVM					
π/4-DQPSK		+/-15		%	
8PSK		+/-12		%	
RX Characteristics					
1. Receiver Sensitivity (BER<0.01%)					
1) π/4-DQPSK		-91		dBm	
2) 8PSK		-89		dBm	
2. Maximum usable signal (BER<0.1%)					
1) π/4-DQPSK		-5		dBm	
2) 8PSK		-5		dBm	

3.6.3 LE Specification

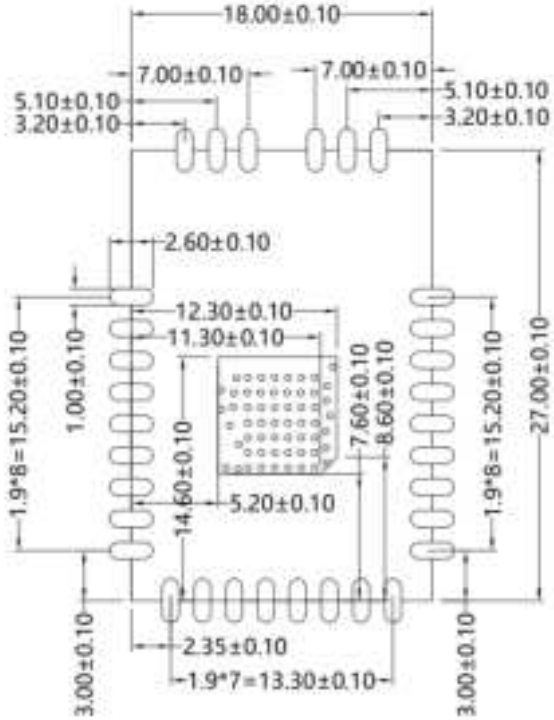
Items	Contents				
Host Interface	USB				
Channel	CH0 to CH39				
	Min.	Typ.	Max.	Unit	
TX Characteristics					
1. Modulation Characteristics					
1)Delta f1(Avg)	225		275	kHz	
2)Delta f2max(For at least 99.9% of all Delta f2max)	185			kHz	
3)Delta f2/ Delta f1	0.8	0.94		Hz/Hz	
2. Carrier frequency offset and drift					
1) Frequency Offset	-150		150	kHz	
2) Frequency Drift	-50		50	kHz	
3) Max Drift Rate	-20		20	Hz/us	
3.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	

4. Reference Design

4.1 SCH



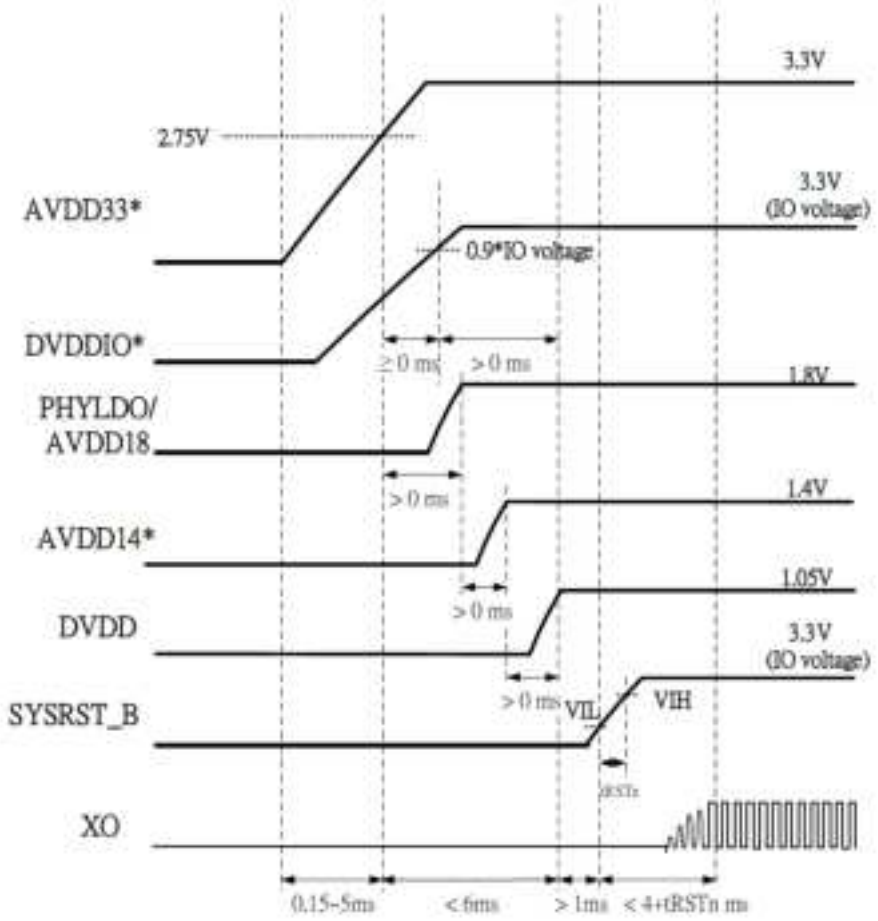
4.2 Recommend PCB Layout Decal



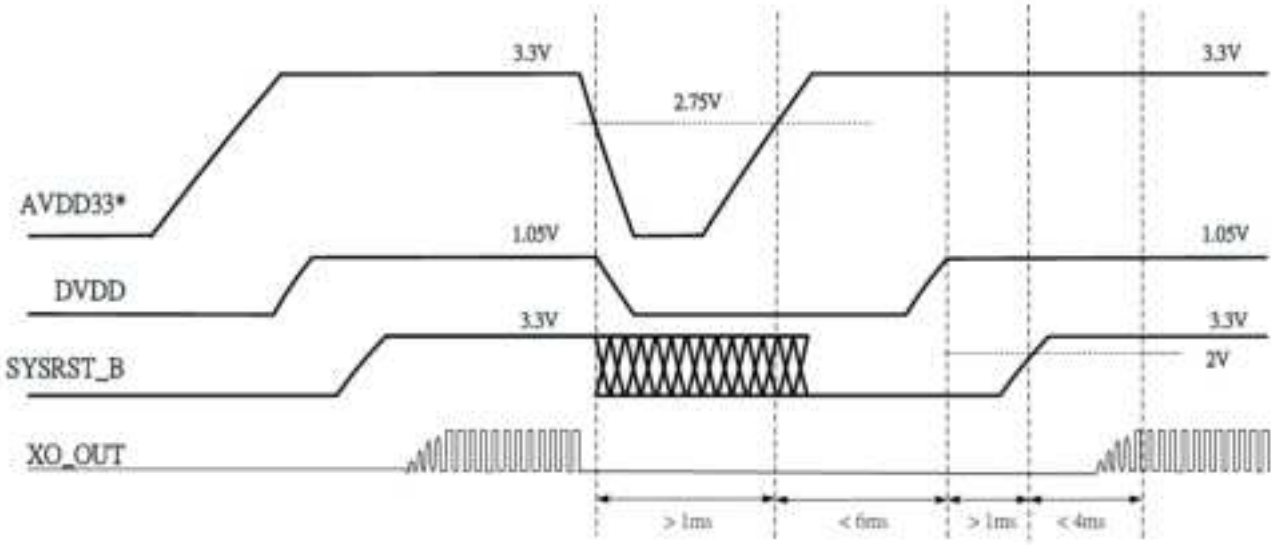
LAYOUT
TOP VIEW

5. Host Interface Timing Diagram

5.1 Chip power on sequence



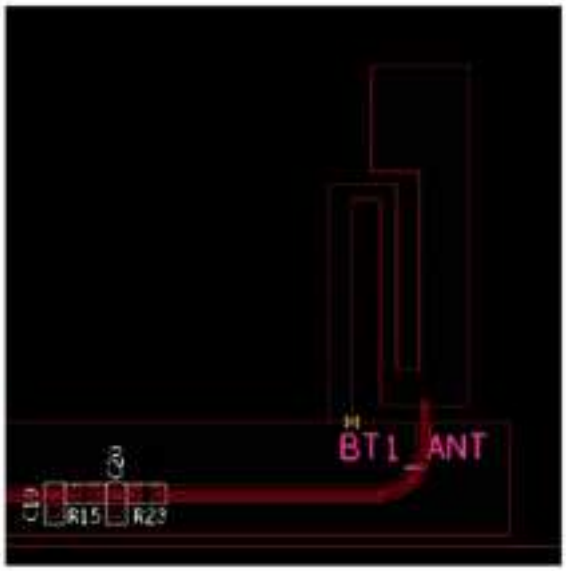
5.1 reset sequence



6. Software Requirements

The driver supports the following operating systems: Linux, Microsoft Windows XP, Vista and Win7.
Mfg. software tool is MT7663BUN_QA_Tool.

7. Antenna Information



PCB type: FR4 with 1.6mm thickness
Antenna pattern: PCB line with 16.8mm length x 7.1mm width
Antenna gain: 0.37dBi
Antenna impedance: 50ohm
Radiation pattern: none

PCB type: FR4 with 1.6mm thickness
Antenna pattern: PCB line with 16.5mm length x 11.3mm width
Antenna gain: 2.65dBi
Antenna impedance: 50ohm
Radiation pattern: none

PCB type: FR4 with 1.6mm thickness
Antenna pattern: PCB line with 19mm length x 10mm width
Antenna gain: 0.29dBi
Antenna impedance: 50ohm
Radiation pattern: none

8. DC Characteristics

Symbol	Parameter	Min	Type	Max	Unit
DVDDIO	3.3V IO Voltage	2.97	3.3	3.63	V
V_{IL}	Input Low Voltage	-0.3	-	VDD33*0.25	V
V_{IH}	Input High Voltage	VDD33*0.625	-	VDD33+0.3	V
V_{OL}	Output Low Voltage	-0.3	-	0.4	V
V_{OH}	Output High Voltage	VDD33-0.4		VDD33+0.3	V

FCC Statement:
Please take attention that changes or modification not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
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 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.

(1) Operational use conditions
Module has professional users use condition limitations, Host product manufacturer please ensure giving such warning like "Product is limited to professional users use" in your product's instruction.

(2) Antenna used

	Antenna type	Max. Antenna Gain
BT/BLE	PCB Antenna	0.37dBi
2.4G Wi-Fi	PCB Antenna	Antenna 1: 0.06dBi Antenna 2: 2.65dBi
5G Wi-Fi	PCB Antenna	Antenna 1: U-NII-1: 0.29dBi U-NII-3: -1.16dBi Antenna 2: U-NII-1: 0.12dBi U-NII-3: 0.99dBi

(3) Labelling Instruction for Host Product Integrator
Please notice that if the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. For FCC, this exterior label should follow "Contains FCC ID: 2AL8S-0302C3XN-1". In accordance with FCC KDB guidance 784748 Labeling Guidelines.
§15.19 and RSS-Gen Labelling requirements shall be complied on end user device. Labelling rules for special device, please refer to §2.925, § 15.19 (a)(5) and relevant KDB publications. For E-label, please refer to §2.935.

(4) Installation Notice to Host Product Manufacturer

The OEM integrator is responsible for ensuring that the end-user has no manual instruction to remove or install module.

The module is limited to installation in mobile application, a separate approval is required for all other operating configurations, including portable configurations with respect to §2.1093 and difference antenna configurations.

(5) Antenna Change Notice to Host manufacturer

If you desire to increase antenna gain and either change antenna type or use same antenna type certified, a Class II permissive change application is required to be filed by us, or you (host manufacturer) can take responsibility through the change in FCC ID and IC ID (new application) procedure followed by a Class II permissive change application.

(6) FCC other Parts, Part 15B Compliance Requirements for Host product manufacturer

This modular transmitter is only FCC authorized for the specific rule parts listed on our grant, 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.
Host manufacturer in any case shall ensure host product which is installed and operating with the module is in compliant with Part 15B requirements.
Please note that For a Class B or Class A digital device or peripheral, the instructions furnished the user manual of the end-user product shall include statement set out in §15.105 Information to the user or such similar statement and place it in a prominent location in the text of host product manual. Original texts as following:

For Class B
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.

For Class A
Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.