



BL-M5621DS2A

**IEEE 802.11b/g/n/ac 866Mbps
2T2R SDIO WiFi+BT5.1 Module
Specification**



Top view

Module Name: BL-M5621DS2A

Module Type: IEEE 802.11b/g/n/ac 866Mbps 2T2R SDIO WiFi+BT5.1 Module

Revision: V1.0

Customer Approval:

Company:

Title:

Signature:

Date:

BL-link Approval:

Title:

Signature:

Date:

Revision History

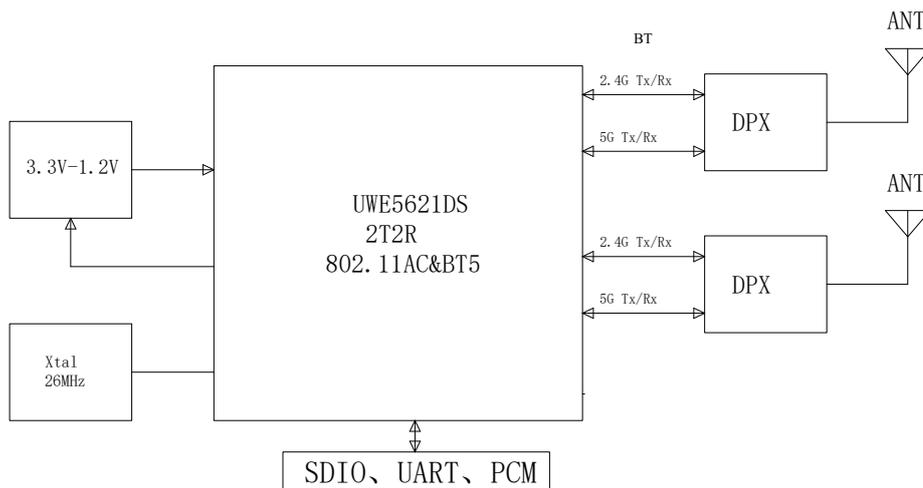
Revision	Summary	Release Date
1.0	Official release	2020-12-11

1. Introduction

BL-M5621DS2A module design is based on UWE5621DS solution, The UWE5621DS is a highly integrated 2-in-1 connectivity single chip which has built in a 2x2 dual-band wireless LAN radio and Bluetooth radio. It includes 2.4 GHz and 5 GHz WLAN IEEE 802.11 a/b/g/n/ac 2x2 MU-MIMO 20/40/80 MHz VHT R2 MAC/PHY/Radio, Bluetooth 5 with supporting high power mode, Mesh, Direction Finding and Long Range. Additionally, this radio-on-a-chip integrates power amplifiers, receive low noise amplifiers and RF TR switch. It supports SDIO 3.0 and PCIe Gen 2 compliant slave interfaces for Wi-Fi, high-speed 4-wire UART for Bluetooth.

1.1 RF module Overview

The general HW architecture for the module is shown in Figure 1.



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/4.2/5.0

1.3 System Functions

Table1: General Specification as below:

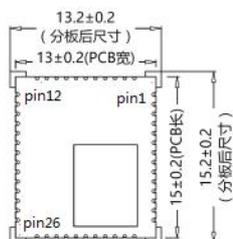
Main Chipset	Uwe5621DS
Operating Frequency	2.4G/5G
WiFi Standard	802.11a/b/g/n/ac (2x2)
Bluetooth	2.1+EDR/4.2/5.0
Modulation	WIFI:11b: DBPSK, DQPSK and CCK and DSSS 11a/g: BPSK, QPSK, 16QAM, 64QAM and OFDM 11n: BPSK, QPSK, 16QAM, 64QAM and OFDM 11ac: BPSK, QPSK, 16QAM, 64QAM,256QAM and OFDM BT: FHSS,GFSK,DPSK,DQPSK
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	50pins
Host Interface	SDIO/UART/PCM
PCB Stack	4-layers design
Dimension	Typical, 13.0mmx 15.0mm x 1.80mm
Antenna	External Antennas Design
Operation Temperature	-10°C to +70°C
Storage Temperature	-40°C to +125°C
Operation Voltage	3.3V +/-10%

2.0 Mechanical Specification

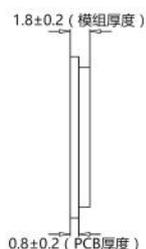
2.1 Mechanical Outline Drawing

Typical Dimension (W x L): 13.0mmx 15.0mm x 1.80mm

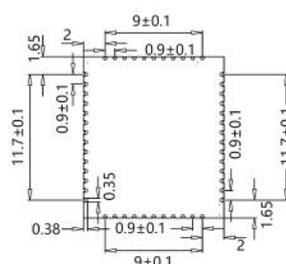
General tolerance: $\pm 0.20\text{mm}$



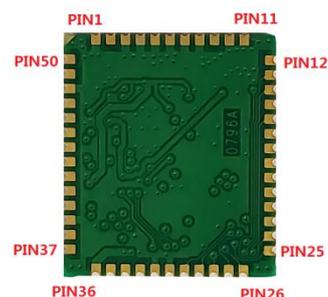
正面视图



侧面视图



背面视图



Pin	Define	Description	Pin	Define	Description
1	GND	GND	26	ESMD1	ESMD1
2	ANT0	ANT 0+BT	27	IISLRCK	IISLRCK
3	GND	GND	28	IISDI	IISDI
4	GND	GND	29	IISDO	IISDO
5	GND	GND	30	IISCLK	IISCLK
6	GND	GND	31	GND	GND
7	GND	GND	32	GND	GND
8	GND	GND	33	ESMD2	ESMD2
9	ANT1	ANT 1	34	VDD1V8	1.8V Supply for GPIO
10	GND	GND	35	RFCTL4	RFCTL4
11	GND	GND	36	VDD33	VDD INPUT (3.3V)
12	RF_BT (NC)	BT ANT (NC)	37	RFCTL5	RFCTL5
13	ESMCLK	ESMCLK	38	RST_N	RST_N
14	ESMCSN	ESMCSN	39	GND	GND
15	CHIP_EN	PMU-Enable	40	U0TXD	U0TXD
16	ESMD3	ESMD3	41	UORXD	UORXD
17	SD_CMD	SDIO Command Input	42	UORTS	UORTS
18	SD_CLK	SDIO Clock Input	43	UOCTS	UOCTS
19	SD_D3	SDIO Data Line 3	44	U2TXD	U2TXD
20	SD_D2	SDIO Data Line 2	45	GPIO2	GPIO2
21	SD_D0	SDIO Data Line 0	46	U1TXD	U1TXD
22	SD_D1	SDIO Data Line 1	47	U1RXD	U1RXD
23	GND	GND	48	GND	GND

24	GPI01	GPI01	49	U2RXD	U2RXD
25	ESMDO	ESMDO	50	INT	INT

3. 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 (3.0V, 3.3V, 3.6V).

3.1 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 @ 11a				
Data rate	6, 9, 12, 18, 24, 36, 48, 54Mbps				
TX Characteristics	Min.	Typ.	Max.	Unit	Remark
1. Power Levels					
1) 15dBm Target (For Each antenna port) @ 11g 54Mbps	13±2	15±2	18±2	dBm	
2) 15dBm Target (For Each antenna port) @ 11a 54Mbps	11±2	13±2	15±2	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	-	-27	-25	dB	
4. Frequency Error					
1) IEEE802.11g/a	-10		10	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
5. Minimum Input Level Sensitivity(each chain)					
1) 6Mbps (PER ≤ 10%)	-		-82	dBm	
2) 9Mbps (PER ≤ 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/a	-20	-5	-	dBm	

3.2 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	Remark
1. Power Levels(Calibrated)					
1) 17dBm Target (For Each antenna port) @1Mbps~11Mbps	14 \pm 2	16 \pm 2	18 \pm 2	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	-	-20	-10	dB	
4. Frequency Error	-10	-	10	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
5. Minimum Input Level Sensitivity(each chain)					
1) 1Mbps (FER \leq 8%)	-		-76	dBm	
2) 2Mbps (FER \leq 8%)	-		-76	dBm	
3) 5.5Mbps (FER \leq 8%)	-		-76	dBm	
4) 11Mbps (FER \leq 8%)	-		-76	dBm	
6. Maximum Input Level (FER \leq 8%)	-10	-5	-	dBm	

3.3 IEEE 802.11n HT20 Section:

Items	Contents				
Specification	IEEE802.11n HT20 @ 2.4G/5G				
Mode	BPSK, QPSK, 16QAM, 64QAM and OFDM				
Channel	CH1 to CH13 @ 2.4G CH36 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. Power Levels					
1) 14dBm Target (For Each antenna port) @ 2.4G MCS7	12±2	14±2	18±2	dBm	
2) 14dBm Target (For Each antenna port) @ 5G MCS7	12±2	14±2	16±2	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	-27	dB	
4. Frequency Error					
1) IEEE802.11n HT20 @ 2.4G/5G	-10	-	10	ppm	
RX Characteristics	Min.	Typ.	Max.	Unit	
5. 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%)					
1) IEEE802.11n HT20 @ 2.4G/5G	-20	-6	-	dBm	

3.4 IEEE 802.11n HT40 Section:

Items	Contents					
Specification	IEEE802.11n HT40 @ 2.4G/5G					
Mode	BPSK, QPSK, 16QAM, 64QAM and OFDM					
Channel	CH3 to CH11 @ 2.4G CH38 to CH163 @ 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. Power Levels						
1) 14dBm Target (For Each antenna port) @ 2.4G MCS7	12±2	14±2	18±2	dBm		
2) 14dBm Target (For Each antenna port) @ 5G MCS7	12±2	14±2	16±2	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	-	-30	-28	dB		
4. Frequency Error						
1) IEEE802.11n HT40 @ 2.4G	-10	-	10	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%)						
1) IEEE802.11n HT40 @ 2.4G/5G	-20	-6	-	dBm		

3.5 IEEE 802.11 ac Section:

Items	Contents				
Specification	IEEE802.11ac @ 5G				
Mode	BPSK, QPSK, 16QAM, 64QAM, 256QAM and OFDM				
Channel	CH36 to CH165 @ VHT-20 CH38 to CH163 @ VHT-40 CH42 to CH157 @ VHT-80				
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					
1) 13dBm Target (For Each antenna port) @ MCS9	10±2	12±2	15±2	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			-27	dB	
9) MCS8			-30		
10) MCS9		-32	-32		
4. Frequency Error					
1) IEEE802.11ac	-10		10	ppm	
RX Characteristics	Max.			Unit	
5. Minimum Input Level Sensitivity(each chain)	VHT20	VHT40	VHT80		
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		

10) MCS9 (PER \leq 10%)		-54	-51		
6. Maximum Input Level (PER \leq 10%)					
1) IEEE802.11ac	-30		-	dBm	

3.6 Bluetooth Section:

3.6.1 BR Specification

Items	Contents				
	Min.	Typ.	Max.	Unit	
Host Interface	UART				
Antenna Reference	Small antennas with 0~2 dBi peak gain				
Channel	CH0 to CH78				
Modulation	GFSK				
	Min.	Typ.	Max.	Unit	
TX Characteristics					
1. Output Average Power	-6 \pm 2	5 \pm 2	10 \pm 2	dBm	
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/50us	
RX Characteristics					
1. Receiver Sensitivity (BER<0.1%)		-91		dBm	
2. Maximum usable signal (BER<0.1%)		-5		dBm	

3.6.2 EDR Specification

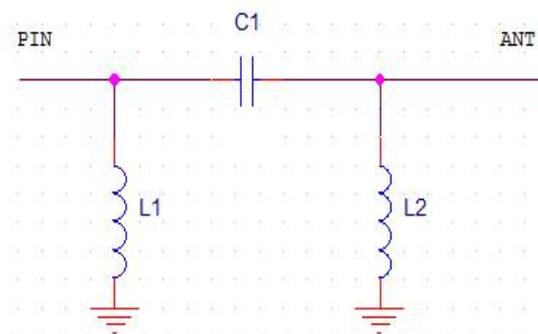
Items	Contents				
Host Interface	UART				
Antenna Reference	Small antennas with 0~2 dBi peak gain				
Channel	CH0 to CH78				
Modulation	$\pi/4$ -DQPSK 、 8PSK				
	Min.	Typ.	Max.	Unit	
TX Characteristics					
1. Relative Transmit Power					
1) $\pi/4$ -DQPSK		-1.5		dBm	
2) 8PSK		-1.5		dBm	
2. Frequency Stability					
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	UART				
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		0±2		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%)		-91		dBm	
2. Maximum usable signal (BER<30.8%)		-5		dBm	

1. Antenna matching

The BT RF , ANT0 and ANT1 Pin connect to antenna, please refer to design demand



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 20cm 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-M5621DS2A** "

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

This module is Limited single modular without shielding, host manufacturer have to consult with module manufacturer for the module limiting conditions when integrate the module in the host. module manufacturer should reviews detailed test data or host designs prior to giving the host manufacturer approval.

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-M5621DS2A** 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	/	2.0dBi	/	/	/	/
5000-6000 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-M5621DS2A".

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.