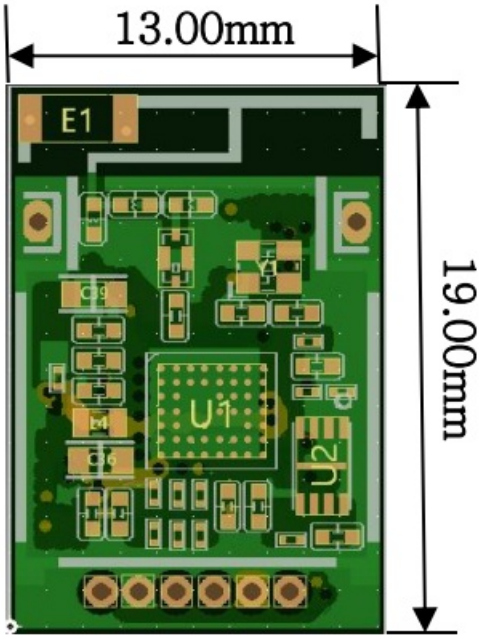
woosim systems WSM-M3W Bluetooth Module User Manual

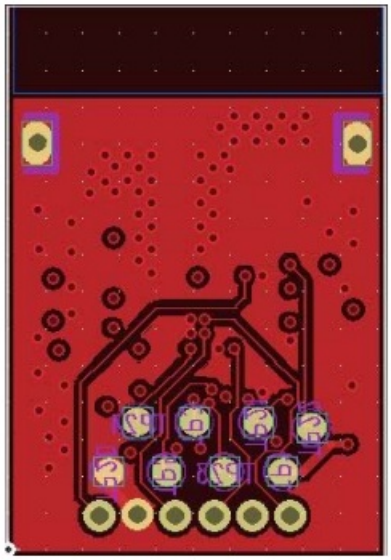
Contents

woosim systems WSM-M3W Bluetooth Module

Overview

WSM-M3W is a compact Bluetooth module satisfies Bluetooth core specification version 5.2.





General description

- Support Bluetooth core 5.2 BR/EDR/BLE and integrated class 1 PA
- Integrated 4Mb serial flash
- Support Bluetooth class 2
- Support up to 2 UART port
- LE data rate up to 1 Mbps
- BLUETOOTH SMART READY : Supports BLE and BR/EDR
- Supports Adaptive Frequency Hopping(AFH)
- Simply replace wired serial cable over Bluetooth device
- Integrated antenna(No need external antenna)
- User specific command support
- After boot, entering SPP Server/BLE Peripheral connecting ready state
- Support low power mode. Sniff mode support

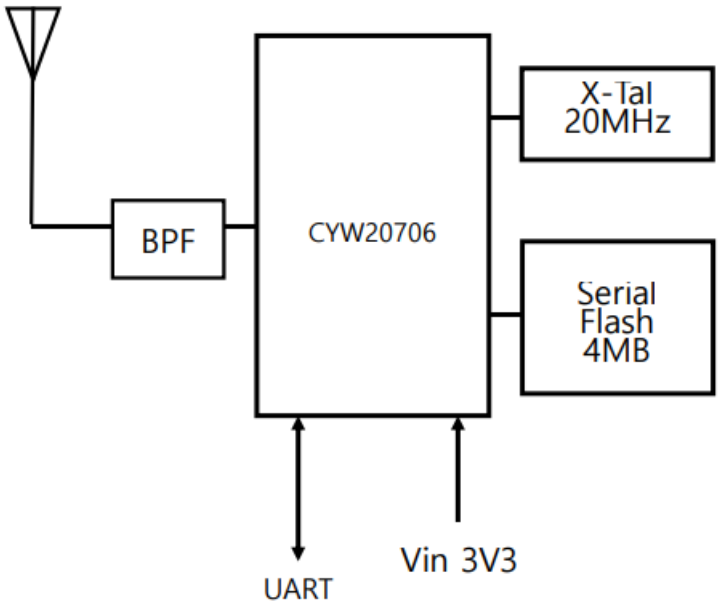
Specification

- Bluetooth core specification version 5.2
- **Radiofrequency:** 2,400 ~ 2,483 MHz
- **Support protocol :** L2CAP, RFCOMM, SDP, ATT
- **Support profile(BR/EDR):** GAP, SDAP, DIP, SPP
- **Support profile(BLE):** GATT, DIS, BLE-SPP (Proprietary protocol) Output power : Power class 2
- **RX sensitivity:** Normal -93.5dBm
- **Maximum data rate :** 3Mbps (BR/EDR. Normally use 1.5Mbps) Operating voltage : 3.3V
- **Temperature range:** -30 ~ +105℃ (storage temperature: -40 to 150℃) Size : 13.0mm X 19.0mm X 1.9mm
- **PCB Thickness:** 0.8 T

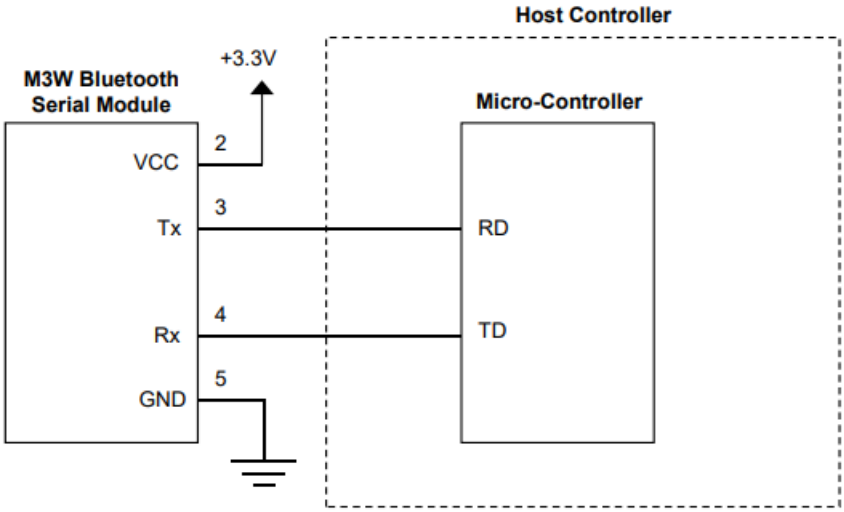
Applications

- Portable printer
- Portable scanner and bar code
- POS terminal
- Wireless data collection device
- Medical devices
- Industrial equipment, factory automation equipment Mobile phone, Computers, PDA

Block diagram



Module size



PIN description

Number	Pin	I/O	Description
1	PIO_5	Output	GPIO (reserved)
2	VCC	Power	3.3V
3	TX	Output	UART TX line
4	RX	Input	UART RX line
5	GND	Ground	Ground
6	PIO_6	Output	GPIO (reserved)

Factory settings

Configuration of Bluetooth parameters – Factory setting

No	**Parameter**	**Value**
1	Local Device Name	**“WOOSIM BR/EDR”**
2	BLE Device Name	**“WOOSIM BLE(V5.2)”**

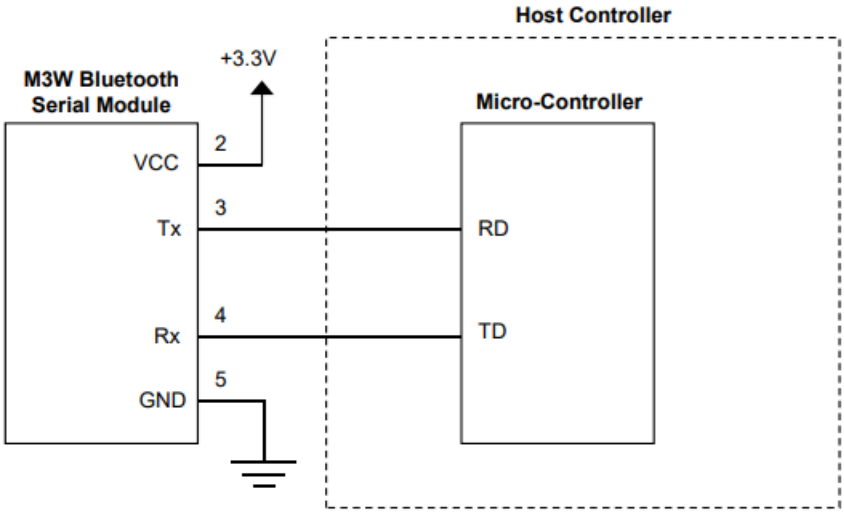
2	Bluetooth Service Name	**“BT SERIAL”**
3	Bluetooth Device Address	**“1C B8 57 08 00 00” ~ “1C B8 57 FF FF FF”**
4	PIN Code	**“1234” (ASCII)**
5	UART Baud Rate	**57,600bps**
6	UART Parity	**None**
7	UART Stop Bit	**1**
8	UART Flow Control	**None**
9	Class Of Device	**Printer (0x040680)**
10	Security Mode	**BR/EDR: Level-3 (Using PIN Code)** **BLE: Just Works**
11	Operating Mode	**Active and Sniff Mode Support** **Transparent Mode**
12	Page Scan Mode	**When connected: Non-connectable** **When disconnected: connectable**
13	Inquiry Scan Mode	**When connected: Non-discoverable** **When disconnected: discoverable**

14	Link Timeout	**Link Supervision Timeout = 0.625ms X 0x7D00 = 20sec**

Usage

Connect to external hardware

To apply the M3W Bluetooth serial module to an existing product, connect Tx (Pin 3) to the receive data (RD) pin of the microcontroller as shown in the figure below, and connect the transmit data (TD) pin of the microcontroller to Rx (Pin 4) connect to The M3W model is used when directly connected to the host CPU with 3.3V logic level.



Operation for BR/EDR

- M3W Bluetooth serial module operates as follows.
- **Standby mode:** When power is applied, the internal initialization procedure is carried out and then it enters standby mode and waits for a Bluetooth pairing request from the outside.
- **Bluetooth connection:** If there is a Bluetooth pairing request from the outside in standby mode, the pairing operation is performed. The pairing process includes checking whether a legitimate device requests a connection using a 4-digit PIN code. When pairing is established, it enters a mode in which other devices do not accept pairing requests (If the connected device supports BT2.1 or higher, SSP is supported. In this case, SSP mode is based on Just Works mode).
- **Data reception:** When data is received from the connected Bluetooth device, it is output to the host controller through the Tx (Pin 3) port.
- **Data transmission:** When data is input from the Host Controller to the Rx (Pin 4) port, it is transmitted to the connected Bluetooth device.

Operation for Low Energy

- The M3W Bluetooth serial module operates as follows.
- **Standby mode:** Enter into BLE ADVERTISING MODE and execute advertising in low power mode.
- **BLE connection:** CENTRAL device detects this and connects BLE LINK. Profiles supported by BLE are as follows.

- DEVICE INFORMATION PROFILE
- SERIAL SERVICE
- Since it supports dual mode operation, 2.2 and 2.3 are supported at the same time. Only one connection is allowed at a time.

$BLE Operation descript

BLE setup

- In BLE and BR/EDR operation, BR/EDR mode operation takes precedence over BLE operation. In other words, it is possible to operate only in BR/EDR mode by turning off the BLE operation if necessary.
- The method of stopping the operation of BLE can be written by changing the setting of the internal memory (PS KEY) value, and it can also be changed through the UART command when the Bluetooth link is not connected.

BLE and BR/EDR operation

- In the state in which BLE operation is enabled, it is discovered as two devices from the outside. (DUAL
- MODE operation). If a link is connected with priority among BLE or BR/EDR, the other cannot be used.
- That is, when the BLE link is connected, the BR/EDR link cannot be used, and when the BR/EDR linker is connected, the BLE link cannot be connected.

BLE service and UUID

- The services that can be used by connecting BLE are as follows.
- **Device Information Service :** This profile is supported by the Bluetooth SIG. In general, general information related to the device can be read.
- **Serial Profile Service :** This is an internal profile that is not supported by Bluetooth. According to the recommendation of the Bluetooth SIG, 128 bits UUID is used, and it is divided into two characteristics: transmission and reception.

Description	**Primary Service**	**Characteristic**
Device Information Service	180A	
n SYSTEM ID		2A23
n MODEL NUMBER		2A24
n SERIAL NUMBER		2A25
n FIRMWARE REVISION		2A26
n HARDWARE REVISION		2A27
n SOFTWARE REVISION		2A28
n MANUFACTURER NAME		2A29
n PNP ID		2A50
SERIAL SERVICE	A9FE5E12DE714020B2CF8BF7**6** **4**FB0A8D	
n TX characteristic		A9FE5E12DE714020B2CF8BF7**65**FB0A8D
n RX characteristic		A9FE5E12DE714020B2CF8BF7**66**FB0A8D

<Table 3-1: BLE UUID>

Description	VALUE
Device Information Service	
n SYSTEM ID	N/A
n MODEL NUMBER	“M3W”
n SERIAL NUMBER	N/A
n FIRMWARE REVISION	“FW-0407”
n HARDWARE REVISION	N/A
n SOFTWARE REVISION	0401
n MANUFACTURER NAME	“WOOSIM”
n PNP ID	N/A
n Certification Data	N/A

<Table 3-2: BLE DEVICE INFORMATION>

Electrical specification

Absolute maximum ratings

Ratings	Symbol	Min	Max	Unit
Supply voltage	VBAT	3.0	3.6	V
Operating Temperature		-30	105	℃
Storage Temperature		-40	150	℃
ESD tolerance HBM1		-2000	2000	V
ESD tolerance MM2		-100	100	V
ESD tolerance CDM3		-500	500	V

1. Human Body Model
2. Machine Model
3. Charged Device Model

Recommended operating conditions and digital I/O characteristics

Characteristics		Symbol	Min	Max	Unit
Supply voltage		VDDIO	3.1	3.5	V
Digital I/O Input_Low	VDDIO=1.8V	VIL	–	0.6	V
	VDDIO=3.3V		–	0.8	V
Digital I/O Input_High	VDDIO=1.8V	VIA	1.1	–	V
	VDDIO=3.3V		2.0	–	V
Digital I/O Output_Low	–	VOL	–	0.4	V
Digital I/O Output_High	–	VOH	VDDIO-0.4V	–	V
Input capacitance (VDDMEM domain)		CIN		0.4	pF

Operation mode current consumption

Bluetooth, BLE, BR and EDR Current Consumption, Class1

Mode	Remarks	Typ	Unit
3DH5/3DH5	–	38.2	mA

BLE			
BLE	Connected 600 ms interval	211	uA
BLE ADV	Unconnectable 1.00 sec	176	uA
BLE Scan	No devices present. A 1.28-sec interval with 11.25 ms scan window .	355	uA
DMx/DHx			
DM1/DH1	–	32.15	mA
DM3/DH3	–	38.14	mA
DM5/DH5	–	38.46	mA
HID OFF	Deep sleep	3	uA
Page scan	Periodic scan rate is 1.28 sec	486	uA
Receive			

1Mbps	Peak current level during reception of a basic-rate packet.	26.4	mA
EDR	Peak current level during the reception of a 2 or 3 Mbps rate packet	26.4	mA
Sniff slave			
11.25ms	–	4.95	mA
22.5ms	–	2.6	mA
495ms	Based on one attempt and no timeout.	254	uA
Transmit			
1Mbps	Peak current level during the transmission of a basic-rate packet: GFSK output power = 10 dBm.	57	mA
EDR	Peak current level during the transmission of a 2 or 3 Mbps rate packet. EDR output power = 8 dBm.	50	mA

Bluetooth and BLE Current Consumption, Class 2 (0 dBm)

Mode	Remarks	Typ	Unit
3DH5/3DH5	–	33	mA
BLE			
BLE ADV	Unconnectable 1.00 sec	174	uA
BLE Scan	No devices present. A 1.28-sec interval with 11.25 ms scan window .	368	uA
DMx/DHx			
DM1/DH1	–	27.5	mA
DM3/DH3	–	31.4	mA
DM5/DH5	–	32.4	mA

RF Characteristics

Transmitter (Class 2)

Specification	Condition	Min	Typ	Max	Unit
Frequency Range		2402		2480	MHz
Output transmit power		-6		4	dBm

Transmit power density				4	dBm
Transmit power control		2		8	dBm
20dB bandwidth for modulated carrier				1	MHz
Adjacent channel transmit power				-20	dBm
				-40	dBm
				-40	dBm
Maximum Modulation		140	163	175	kHz
		115			kHz
				80	%
Initial carrier frequency tolerance		-75		75	kHz
Carrier frequency Drift	One slot packet(DH1)	-20			kHz
	Three slot Packet(DH3)	-40			
	Five slot packet(DH5)	-40			
	30MHz ~ 1GHz			-36	

TX Spurious Emissions	1GHz ~12.75GHz			-30	dBm

	1.8GHz ~1.9GHz			-47	
	5.15GHz ~5.3GHz			-47	

Receiver

Specification	Condition	Min	Typ	Max	Unit
Sensitivity at 0.1% BER for all packet	Single-slot packets			-83	dBm
Maximum input level	GFSK, 1 Mbps			-20	dBm
C/I performance	co-channel			11	dB
	1MHz (Adjacent channel)			0	
	2MHz (2nd Adjacent channel)			-30	
	3MHz (3rd Adjacent channel)			-40	
	30MHz ~ 2000MHz		-10		
	2000MHz ~ 2400MHz		-27		

Out-of-Band, Blocking Performance	2500MHz ~ 3000MHz		-27		dBm
	3000MHz ~ 12.75GHz		-10		
Intermodulation Performance	Df = 5 MHz	-39			dBm
RX Spurious Emissions	30MHz ~ 1GHz			-57	dBm
	1GHz ~12.75GHz			-47	

BLE RF Specifications

Specification	Condition	Min	Typ	Max	Unit
Frequency Range		2402		2480	MHz
TX Output power				10	dBm
RX Sensitivity	GFSK, 1 Mbps, 0.1%BER		-95		dBm
Modulation Characteristic		225	255	275	kHz
		99			%
		0.8			%

Interface

VDD in

- Input voltage. The power supply should be support 3.3V.
- **MIN :** 1.62V
- **TYP :** 3.3V
- **MAX :** 3.6V (Max 3.795V)

UART (Peripheral UART)

- Peripheral UART connecting to host MCU.
- **HW FIFO:** TX/RX 256 bytes
- **Min Baud Rate:** 2400 bps
- **Max Baud Rate :** 3 Mbps
- **Default Baud Rate:** 57600 bps
- **MAX :** 3.6V (Max 3.795V)

GPIO

- Up to 2 GPIO.
- Set HIGH when Bluetooth link has been connected. Otherwise set to LOW.

SPI

- Up to two SPI support. SPI connection is not allows in M3W.
- SPI is dedicated to communicate to Serial Flash.

Primary UART

- Dedicated for firmware download.
- Enable HW flow control. Only used factory production.

Handling Precautions

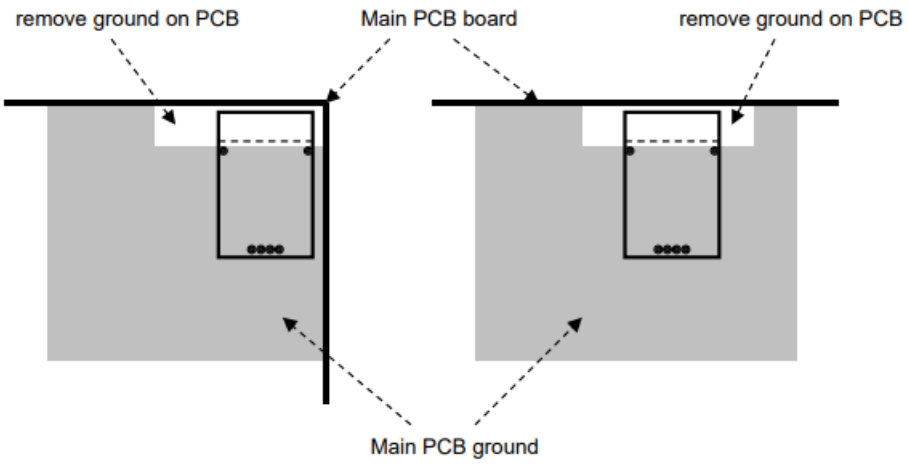
General

- The points to be noted when handling the M3W Bluetooth serial module are as follows.
- When handling the module, provide anti-static measures to avoid damage by static electricity.
- Use a large enough current source to ensure sufficient current is supplied to the power input stage.
- Be careful not to input more than the rated power voltage or RF signal.

RF Performance

- In order to maximize the RF performance of the product equipped with the M3W Bluetooth serial module, the PCB design should be done with the following considerations in mind.
- Stable RF performance can be expected only when sufficient ground area is secured on the main PCB.
- Having objects (conductors or non-conductors) close to the antenna is not good as it interferes with the antenna radiation and distorts the pattern. In the case of conductors, it should be at least 10mm apart from the antenna, and in the case of non-conductors such as plastic fixtures, it should be separated by at least 5mm.
- The main PCB should be designed so that the ground plane of the main PCB does not invade the antenna beyond the boundary between the module ground plane and the antenna as shown in the figure below.

Location of module on the main PCB



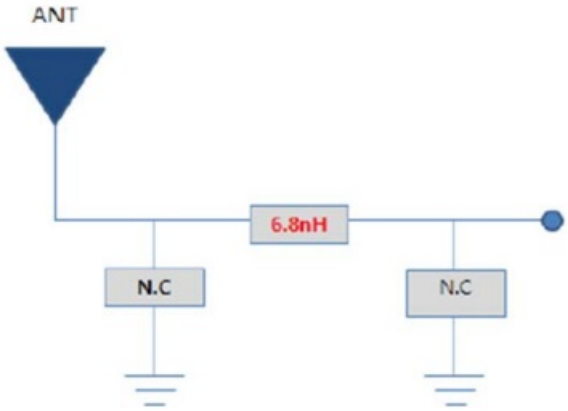
Antenna

General specification

Item		Specifications
Antenna	Center Frequency	2400~2485 ±1MHz
	Band Width	85 MHz
	Polarization	Linear
	Dimension	3.2 * 1.6 * 1.2 mm
	Working Temperature	-40~60°C
	Storage Temperature	-20~40°C

Matching

6.8nH matching circuit.

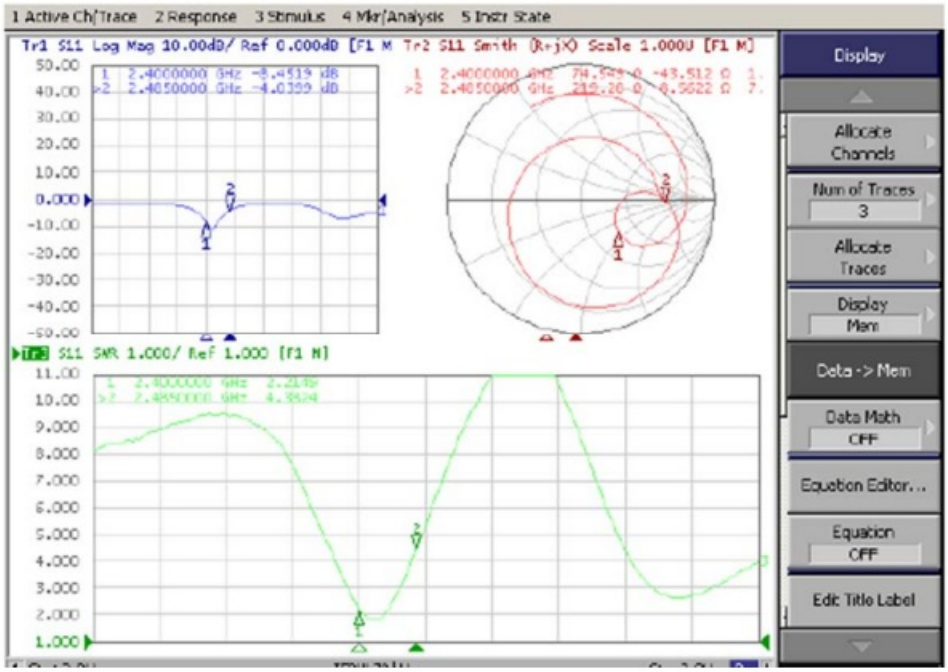


V.S.W.R

Free Space environment.

Mode \ Service(MHz)		2400	2485
VSWR	TEST DATA	2.21	4.38
	SPEC	2.71	4.88

ANT-VSWR, Return loss, Smith chart



FCC Regulation

Part 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.

Part 15.105 Statement(Class B)

- 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.

Part 15.21 Statement

- Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.
- This device must not be co-located or operating in conjunction with any other antenna or transmitter.
- Regulatory notice to host manufacturer according to KDB 996369 D03 OEM Manual v01

List of applicable FCC rules

- This module has been granted modular approval as below listed FCC rule parts.
- FCC Rule parts 15.247

Summarize the specific operational use conditions

- The OEM integrator should use equivalent antennas which is the same type and equal or less gain then an antenna listed in this instruction manual.

RF exposure considerations

The module has been certified for integration into products only by OEM integrators under the following condition:

1. The antenna(s) must be installed such that a minimum separation distance of at least 20 cm is maintained between the radiator(antenna) and all persons at all times.
2. The transmitter module must not be co-located or operating in conjunctionwith any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures.

- As long as the two conditions above are met, further transmitter testing will not be required.
- OEM integrators should provide the minimum separation distance to end-users in their end-product manuals.

Antennas List

- This module is certified with the following antenna.

1. **Type:** Chip Antenna
2. **Max. peak Antenna gain :** -1.07 dBi (2400 – 2485 MHz)

- Any new antenna type, higher gain than listed antenna should be met the requirements of FCC rule 15.203 and 2.1043 as permissive change procedure.

Label and compliance information

End Product Labeling

- The module is labeled with it sown FCC ID and IC Certification Number. If the FCC ID and IC Certification

Number are 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. In that case, the final end product must be labeled in a visible area with the following:

- **Contains FCC ID:** QDDWSM-M3W
- **Contains IC:** 28847-WSMM3W
- Information on test modes and additional testing requirements
- OEM integrator is still responsible for testing their end-product for any additional Compliance requirements required with this module installed(for example, digital device emissions, PC peripheral requirements, additional transmitter in the host, etc.).

Additional testing, Part 15 Subpart B disclaimer

- The final host product also requires Part 15 subpart B compliance testing with the modular transmitter installed to be properly authorized for operation as a Part 15 digital device.

ISED Regulation

RSS-GEN, Sec. 7.1.3–(licence-exempt radio apparatus)

1. This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:
2. This device may does not cause interference, and
3. This device must accept any interference, including interference that may cause undesired operation of the device

RF Exposure

- The antenna (or antennas) must be installed so as to maintain at all times a distance minimum of at least 20 cm between the radiation source (antenna) and any individual.
- This device may not be installed or used in conjunction with any other antenna or transmitter.

Specifications

- **Product Name:** Model No.
  Bluetooth Module: WSM-M3W

Change History

Rev.	Date	Author	Reason for Change
1.1	2022.5.6	pack	Initial version

- **Woosim Systems Inc. 60, Sandan-ro 388beon-gil, Galsan-myeon, Hongseong-gun, Chungcheongnam-do, Korea**
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Documents / Resources

	woosim systems WSM-M3W Bluetooth Module [pdf] User Manual WSM-M3W, WSMM3W, QDDWSM-M3W, QDDWSMM3W, WSM-M3W Bluetooth Module, WSM-M3W Module, Bluetooth Module, Module