GND	ANT
NC	GND
RST	VCC
IO3	RX
IO10	TX
IO9	IO22
NC	IO21
IO8	BOOT
IO7	RES

32.000 MHZ

Data sheet

SHENZHEN NEWBIT INFORMATION TECHNOLOGY LTD.

Contents

1 Device Overview

1.1 Description

MX-01P is a powerful, highly flexible, ultra-low power **Bluetooth® 5.3** module based on **OnChip HBS3526**, which has an Arm® Cortex™-M4+ CPU with the floating-point unit running at 64MHzrich configurable peripheral interfaces, and high-performance low-power Bluetooth RF, transmit power adjustable from -36 dBm to +4dBm, receive sensitivity of -93dBm. In addition, the module also integrates a 32MHz crystal oscillator and IPEX port(RF PCB printed antenna), industrial-grade design, a RoHS process, and half-hole pins for easy production processing.

1.2 Key Features

1.2.1 Hardware Features

- Frequency: 2400 MHz ~ 2483.5 MHz
- Package: 11.3x16.4mm(Half-hole), 18pins
- BLE Compiles with Bluetooth V5.3

- Proprietary 2.4-GHz link controller
  - TX: Up to +4dBm transceiver output power

- RX: -93 dBm sensitivity @ 1 Mbps
- Link layer and AES/CCM integrated
- CPU
  - ARM® Cortex™-M4, max 64MHz
  - Hardware multiplier
- Memory
  - SRAM 80KB
  - Flash 4MB
- Power
  - Power supply range: 1.8 V ~ 3.3 V
- Clock and Timer
  - 32MHz crystal, 32MHz RC, 32.768KHz RC
  - Watchdog

- Peripherals
  - DMA x 8
  - UART x 2
  - Flexible general-purpose I/O
  - up to 18 GPIO
  - SPI master or slave interface x 2
  - Watchdog to prevent system dead lock
  - 16-bit Timer x 4
  - single-end 12-bit GPADC x 8
  - AES HW encryption
- DMA
- Modulation: GFSK
  - Support internal RTC

1.2.2 Software Features

- Serial port transparent transmission, no need for any Bluetooth experience
- The connection interval is 30ms in default
- Support AT command to reset the module and get the MAC address
- Support AT command to adjust transmit power, modify broadcast interval, customize broadcast data, modify serial port baud rate, modify module name
- Support full-featured BT5.3 protocol
- Support tailor-made exclusive software to meet customer needs; CPU frequency is up to 64MHz, and interface resources are rich.
- Support OTA(over-the-air) upgrade function for easy maintenance

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1.3 Applications

- **IoT**

  o Home automation
  o Sensor networks

  o Building automation

  o Industrial automation

- **Personal area networks**

  o Health/fitness sensor and monitor devices
  o Medical devices

  o Key fobs and wrist watches

- **Interactive entertainment devices**

  o Remote controls
  o Gaming controllers

  o VR/AR

- **Enterprise lighting**

  o Industrial
  o Commercial

  o Retail

- **Beacons**

2 Module default parameter configuration

Parameter	Default value
Serial port configuration	115200bps
Module Name	NB-(MAC address)
Broadcast interval	200mS
Connection interval	30mS
TX power	5dBm
BLE Read/Write channel	FFF1/FFF2

3 Mechanical Details and Pin Assignment

3.1 Mechanical Details
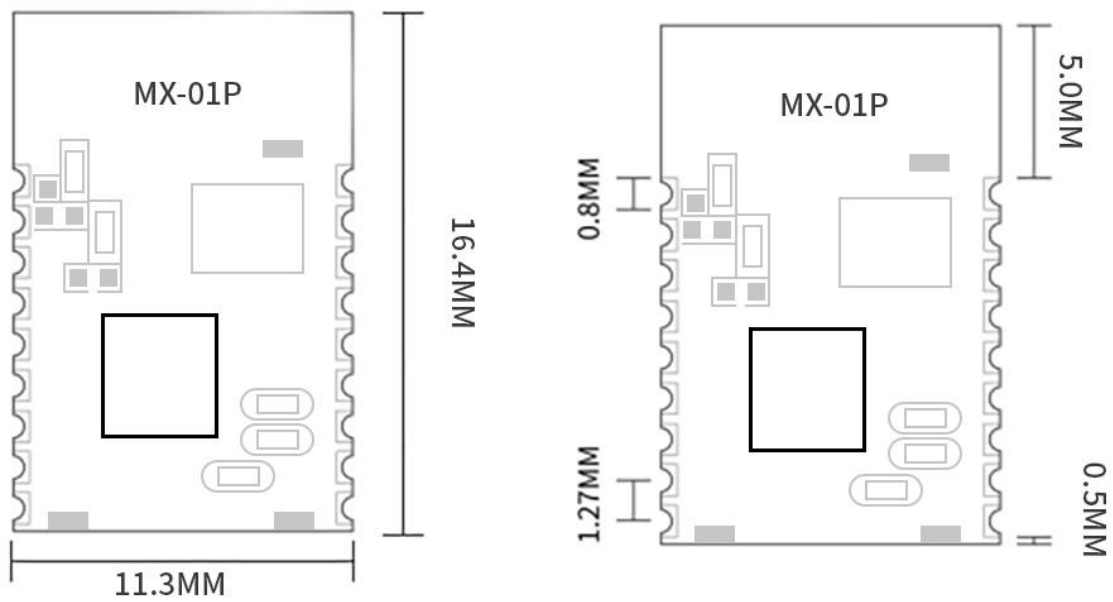
3.2 Pin Assignment
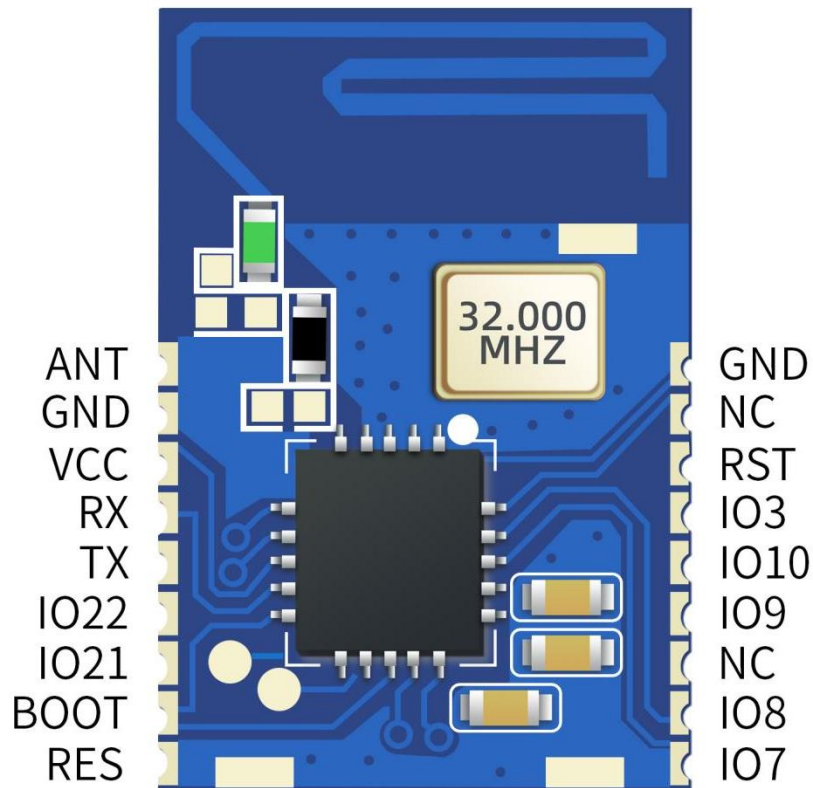
Pin No.	Pin Name	Chip Pin Name	I/O	Description
Pin1	ANT	RF	-	External antenna connector pin
Pin2	GND	GND	-	Module ground
Pin3	VCC	VCC	-	External power input, typical 3.3V supply
Pin4	RX	IO6	I	The pin of the burning program
Pin5	TX	IO5	O	The pin of the burning program
Pin6	CDS	IO22	I	AT command enable pin High level or floating: AT command is valid, non-AT commands are passed through Low level: AT command is invalid, all data on the serial port is passed through
Pin7	LINK	IO21	O	Bluetooth is connected, outputting a high level. Bluetooth is not connected, outputting a low level.
Pin8	BOOT	IO4	I/O	Programming the enable pin
Pin9	FC	IO20	O	Flow control pin. High level indicates that serial port data cannot be sent, while low

				level indicates that serial port data can be sent.
Pin10	GP02	IO7	O	In F002, input a hexadecimal byte. When the 01 control pin is activated, it outputs a high level; when it is 00, it outputs a low level.
Pin11	GP01	IO8	O	In F001, input a hexadecimal byte. When the 01 control pin is activated, it outputs a high level; when it is 00, it outputs a low level.
Pin12	NC	NC	I/O	Reserve
Pin13	RXD	IO9	I	Data serial port RX
Pin14	TXD	IO10	O	Data serial port TX
Pin15	BRTS	IO3	I	Sleep pin: High level or floating: The module enters sleep mode Low level: The module exits sleep mode If low power consumption is not required, it can be directly grounded In sleep mode, the module's serial port can only receive data and cannot send data The MCU can control the module to enter or exit sleep mode through GPIO.
Pin16	RES	IO13	I	Reset pin, pull down the reset
Pin17	NC	NC	I/O	Reserve
Pin18	GND	GND	I/O	Module ground

4 Electrical Characteristics

4.1 Absolute Maximum Ratings

Parameter	Min	Max	Unit
Storage Temperature	-40	105	℃
VDD	-0.3	3.9	V
Other Pins	-0.2	VDD+0.3≤3.9	V

4.2 Recommended operating conditions

Parameter	Min	Recommended Value	Max	Unit
Operating Temperature	-40	—	85	℃
VDD	1.8	3.3	3.6	V

5 AT Commands List

Command	Command Description
AT+MAC?<CR><LF>	Query the MAC address
AT+MAC=<MAC><CR><LF>	Set the MAC address of the module
AT+NAME=<string><CR><LF>	Set the device name
AT+NAME?<CR><LF>	Query the device name
AT+ADV=<num><CR><LF>	Set the broadcasting status
AT+ADV? <CR><LF>	Query the broadcasting status
AT+UART=<num><CR><LF>	Set the baud rate
AT+UART?<CR><LF>	Query the baud rate
AT+DISCONN=<num><CR><LF>	Disconnect the Bluetooth connection
AT+DEV?<CR><LF>	Query the connected device currently
AT+UUIDS=<uuid><CR><LF>	Set the BLE main service channel
AT+UUIDS?<CR><LF>	Query the BLE main service channel
AT+UUIDN=<uuid><CR><LF>	Set the BLE read service channel

AT+UUIDN?<CR><LF>	Query the BLE read service channel
AT+UUIDW=<uuid><CR><LF>	Set the BLE write service channel
AT+UUIDW?<CR><LF>	Query the BLE write service channel
AT+AINTVL=<num><CR><LF>	Modify the broadcasting interval
AT+AINTVL?<CR><LF>	Query the broadcasting interval
AT+VER? <CR><LF>	Query the firmware version
AT+REST=1<CR><LF>	Restore
AT+REBOOT=1<CR><LF>	Set the module to reboot
AT+AMDATA=HEX<CR><LF>	Set custom broadcast data
AT+AMDATA?<CR><LF>	Query custom broadcast data

Remarks:

<CR><LF> is the ASCII code 0x0d and 0x0a；

The serial port prompt for successful power-up or restart(+READY <CR><LF>), the host MCU must receive this message before it can operate instruction and data transmission.

6 AT Commands Specific Description

Query the MAC address

Command Description: Query the address of the Bluetooth module
Read/Write: Read only
Command: AT+MAC? <CR><LF>
Supported parameters: N/A
Setup/Response:

R/W	Command Format	Response	Remarks
R	AT+MAC? <CR><LF>	+MAC: 000102030405<CR><LF>	Return the MAC address: 00:01:02:03:04:05

Set the MAC address of the module

Command Description: Set the MAC address of the Bluetooth module, which will take effect after restarting.

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Read/Write: Write only
Command: AT+MAC=<mac><CR><LF>
Supported parameters: 000000000000-FFFFFFFFFFFF
Setup/Response:

R/W	Command Format	Response	Remarks
W	AT+MAC=<mac><CR><LF>	OK<CR><LF>	Setup successfully
		ERROR<CR><LF>	Setup failure

Set the device name

Command Description: Set the device name, which will take effect immediately.
Read/Write:: Write only
Command: AT+NAME=<string><CR><LF>
Supported parameters: User-defined, the total length does not exceed 20 bytes.
Setup/Response:

R/W	Command Format	Response	Remarks
W	AT+NAME=<string><CR><LF>	OK<CR><LF>	Setup successfully
		ERROR<CR><LF>	Setup failure

Query the device name

Command Description: Query the device name
Read/Write: Read only
Command: AT+NAME? <CR><LF>
Supported parameters: NA
Setup/Response:

R/W	Command Format	Response	Remarks
R	AT+NAME? <CR><LF>	+NAME: <string><CR><LF>	<string> is the current BLE device name

Set the broadcasting status

Command Description: Set the Bluetooth broadcast status of the device, which will take effect immediately, and resume broadcasting after reset and restart.
Read/Write: Write only
Command: AT+ADV=<num><CR><LF>
Supported parameters: 0-Turn off broadcasting 1-Turn on broadcasting
Setup/Response:

R/W	Command Format	Response	Remarks
W	AT+ADV=<num><CR><LF>	OK<CR><LF>	Setup successfully
		ERROR<CR><LF>	Setup failure

Query the broadcasting status

Command Description: Get the hardware version of the module
Read/Write: Read only
Command: AT+ADV?<CR><LF>
Supported parameters: N/A
Setup/Response:

R/W	Command Format	Response	Remarks
R	AT+ADV?<CR><LF>	+ADV: X<CR><LF>	X=0 Device broadcast is turned off X=1 Device broadcasting is turned on

Set the baud rate

Command Description: Set the baud rate
Read/Write: Write only
Command: AT+UART=<num><CR><LF>
Supported parameters: 0:9600, 1:14400, 2:19200, 3:38400, 4:57600, 5:115200
Setup/Response:

R/W	Command Format	Response	Remarks
W	AT+UART=<num><CR><LF>	OK<CR><LF>	Setup successfully
		ERROR<CR><LF>	Setup failure

Query the baud rate

Command Description: Query the baud rate
Read/Write: Read only
Command: AT+UART?<CR><LF>
Supported parameters: NA
Setup/Response:

R/W	Command Format	Response	Remarks
R	AT+UART?<CR><LF>	+UART: <num><CR><LF>	0:9600; 1:14400; 2:19200; 3:38400; 4:57600; 5:115200;

Disconnect the Bluetooth connection

Command Description: Get the current working status of the module
Read/Write: Write only
Command: AT+DISCONN=<num><CR><LF>

Supported parameters: 0-Disconnect all connected slave devices
　　　　　　　　　　1-Actively disconnect from the host device
Setup/Response:

R/W	Command Format	Response	Remarks
W	AT+DISCONN=<num><CR><LF>	+DISCONN: <num>, <MAC><CR><LF>	This machine is disconnected from the <mac> device.

Query the connected device currently

Command Description: Query the connected device currently
Read/Write: Read only
Command: AT+DEV?<CR><LF>
Supported parameters: NA
Setup/Response:

R/W	Command Format	Response	Remarks
R	AT+DEV?<CR><LF>	+DEV:<TYP>,<MAC>	TYP=0 means that the connected device

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		<CR><LF> ...	is the main terminal connected device. TYP=1 means that the connected device is a slave-connected device. <MAC> is the MAC address corresponding to the connected device.

Set the BLE main service channel

Command Description: Set up the BLE main service channel, which will take effect after restarting.
Read/Write: Write only
Command Code: AT+UUIDS=<uuid><CR><LF>
Supported parameters: 16-bit or 128-bit UUID
Setup/Response:

R/W	Command Format	Response	Remarks
W	AT+UUIDS=<uuid><CR><LF>	OK<CR><LF>	Setup successfully
		ERROR<CR><LF>	Setup failure

Remarks:

16bit UUID example: FFF0
128bit UUID example: 11223344556677889900112233445566

Query the BLE main service channel

Command Description: Query the BLE main service channel.
Read/Write: Read only
Command: AT+UUIDS?<CR><LF>
Supported parameters: N/A
Setup/Response:

R/W	Command Format	Response	Remarks
R	AT+UUIDS?<CR><LF>	+UUIDS:<uuid><CR><LF>	Take the value of <UUID> UUID in 16bit format or 128bit format

Set the BLE read service channel

Command Description: Set the BLE read service channel
Read/Write: Write only
Command: AT+UUIDN=<uuid><CR><LF>
Supported parameters: 16-bit or 128-bit UUID
Setup/Response:

R/W	Command Format	Response	Remarks
W	AT+UUIDN=<uuid><CR><LF>	OK<CR><LF>	Setup successfully
		ERROR<CR><LF>	Setup failure

Remarks:

16bit UUID example: FFF1
128bit UUID example: 11223344556677889900112233445566

Query the BLE read service channel

Command Description: Query the BLE read service channel
Read/Write: Read only
Command: AT+UUIDN?<CR><LF>
Supported parameters: NA
Setup/Response:

R/W	Command Format	Response	Remarks
R	AT+UUIDN?<CR><LF>	+UUIDN:<uuid><CR><LF>	Take the value of <UUID> UUID in 16bit format or 128bit format

Set the BLE write service channel

Command Description: Set the BLE write service channel, take effect after reboot.
Read/Write: Write only
Command: AT+UUIDW=<uuid><CR><LF>
Supported parameters: 16-bit or 128-bit UUID
Setup/Response:

R/W	Command Format	Response	Remarks
W	AT+UUIDW=<uuid><CR><LF>	OK<CR><LF>	Setup successfully
		ERROR<CR><LF>	Setup failure

Remarks:

16bit UUID example: FFF2

128bit UUID example: 11223344556677889900112233445566

Query the BLE write service channel

Command Description: Query the BLE write service channel.
Read/Write: Write only
Command: AT+UUIDW?<CR><LF>
Supported parameters: N/A
Setup/Response:

R/W	Command Format	Response	Remarks
R	AT+UUIDW?<CR><LF>	+UUIDW:<uuid><CR><LF>	Take the value of <UUID> UUID in 16bit format or 128bit format

Modify the broadcasting interval

Command Description: Modify the broadcasting interval.
Read/Write: Write only
Command: AT+AINTVL=<num><CR><LF>
Supported parameters: 20 – 10240ms
Setup/Response:

R/W	Command Format	Response	Remarks
W	AT+AINTVL=<num><CR><LF>	OK<CR><LF>	Setup successfully
		ERROR<CR><LF>	Setup failure

Query the broadcasting interval

Command Description: Query the broadcasting interval.
Read/Write: Read only

Command: AT+AINTVL?
Supported parameters: N/A
Setup/Response:

R/W	Command Format	Response	Remarks
R	AT+AINTVL?	+AINTVL:<num><CR><LF>	The interval is in ms.

Query the firmware version

Command Description: Query the firmware version.
Read/Write: Read only
Command: AT+VER?<CR><LF>
Supported parameters: N/A
Setup/Response:

R/W	Command Format	Response	Remarks
R	AT+VER?<CR><LF>	+VER:V1.0.0<CR><LF>	V1.0.0 is the firmware version.

Restore

Command Description: Restore factory settings, this command takes effect after reboot, MAC address cannot be restored after modification.
Read/Write: Write only
Command: AT+RESET=1<CR><LF>
Supported parameters: 1
Setup/Response:

R/W	Command Format	Response	Remarks
W	AT+RESET=1<CR><LF>	OK<CR><LF>	Setup successfully
		ERROR<CR><LF>	Setup failure

Reboot

Command Description: Reboot.
Read/Write: Write only
Command: AT+REBOOT=1<CR><LF>

Supported parameters: 1
Setup/Response:

R/W	Command Format	Response	Remarks
W	AT+REBOOT=1<CR><LF>	OK<CR><LF>	Setup successfully
		ERROR<CR><LF>	Setup failure

Set custom broadcast data

Command Description: Set custom broadcast data.
Read/Write: Write only
Command: AT+AMDATA=HEX<CR><LF>
Supported parameters: User-defined, HEX represents a 0-29 byte length HEX numerical value. For example, if the broadcast data is set to 5 bytes "12345", then the corresponding field would be "AT+AMDATA=3132333435<CR><LF>"
Setup/Response:

R/W	Command Format	Response	Remarks
W	AT+AMDATA=HEX<CR><LF>	OK<CR><LF>	Setup successfully
		ERROR<CR><LF>	Setup failure

Query custom broadcast data

Command Description: Query custom broadcast data.
Read/Write: Read only
Command: AT+AMDATA?<CR><LF>
Supported parameters: N/A
Setup/Response:

R/W	Command Format	Response	Remarks
R	AT+AMDATA?<CR><LF>	+AMDATA:HEX<CR><LF>	successfully set

7 BLE Protocol Description (APP Interface)

Transparent transmission data channel 【Service UUID: 0xFFF0】

Characteristic values UUID	Executable operations	Default Value	Remarks
0xFFF2	Write	No	The written data will be output from the serial TX port.
0xFFF1	notify	No	Data input from the serial RX port will generate a notification to the mobile device on this channel.

Description:

APP sends data to MCU via 0xFFF2 channel. MCU sends data to APP via 0xFFF1 channel. Users can also customize the read/write channel via AT commands.

8 Module Layout Reference Suggestions

Should be no Ground in this area.

Antenna

Shield Case

Mother Board

Recommended location in X-Y plane

No Metal

No Metal

Shield Case

Antenna | **Ble Module**

No Ground in this area | **Mother Board**

Recommended location in Z plane
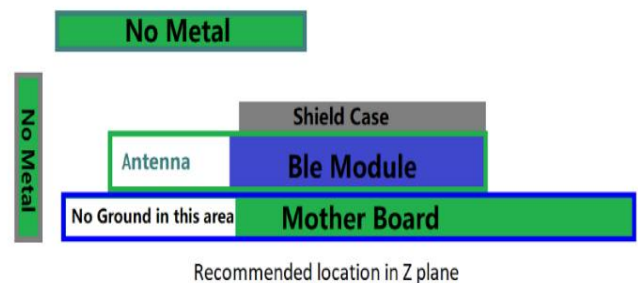
● The module antenna should be placed far away from other circuits, and there should be no wiring or copper plating below it.

● The part of the final user product's casing that is close to the antenna cannot be made of metal materials (including those with metal particle coatings or sprayed coatings).

● It is recommended to use magnetic beads for isolation when connecting the power supply to the module.

● Please check the stability of the power supply and ensure that the voltage does not fluctuate significantly or frequently.

● The grounding of the components should be good to reduce parasitic inductance.

When performing batch soldering for users, the reflow soldering temperature should not exceed 245℃. Please refer to the temperature curve in the following figure.

(°C)

Temperature

250

200

150

100

50

Peak: 240 $^{+5}_{0}$°C

230°C or higher

2°C to 6°C/s

Pre-heating Zone

180°C

150°C

90 ± 30 s

2°C to 4°C/s

20 ± 10 s

(3°C to 6°C/s)

Soldering Zone

Heating time
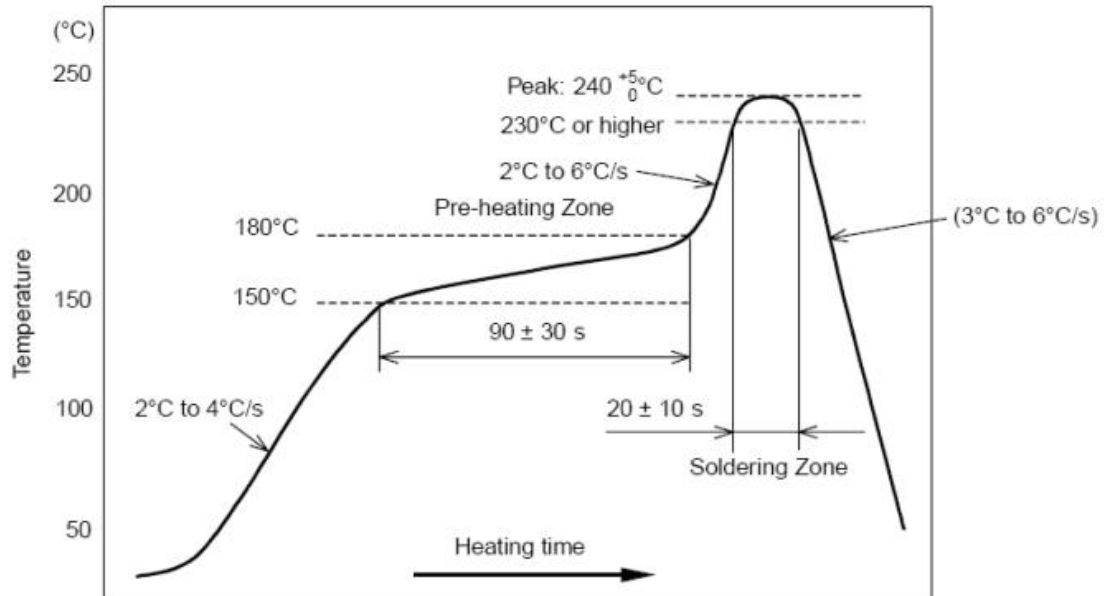
9 Revision History

Revision	Description of changes	Approved	Revision Date
V1.0	Initial Release	Allen	2025.05.27

Notes:

Due to the continuous improvement of the hardware and software of the product, this document may be changed without further notice, and the latest version of the document shall prevail in the end.

For the latest information, please go to the website: www.newbitsiot.com to download, or contact us.

FCC Statement

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.

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.

The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247 & 15.207 & 15.209 & 15.205 and that the 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. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

10 Contact Us

The contents of this data sheet are subject to change without prior notice for further improvement. Newbit team reserves all the rights for the final explanation.

Please contact Newbit sales team or visit www.newbitsiot.com for more related information if needed.

NEWBIT INFORMATION TECHNOLOGY CO., LTD.

16F, Huanancheng Building, Longgang District, Shenzhen, Guangdong, China

Tel: 86-755-23320814

info@newbitsiot.com

www.newbitsiot.com

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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 holder of certificate will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

Radiation Exposure Statement:

This module support BT(2402-2480MHz) which compliance with part 15.247 and apply for Limited module approval . The module is limited to OEM installation only.

The holder of certificate is responsible for ensuring that the end-user has no manual instruction to remove or install module. holder of certificate shall equipped the antenna to compliance with antenna requirement part 15.203& 15.204 and must not be co-located or operating in conjunction with any other antenna or transmitters. And holder of certificate shall implement a Class II Permissive Change (C2PC) or a new FCC ID to demonstrate complied with FCC standard. The holder of certificate is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

The final end product must be labelled in a visible area with the following: "Contains FCC ID: 2A8QD-MX-01P"

ANT

The antenna is PCB antenna, and is permanent connection antenna. the antenna is -0.50dBi,This antenna is permanently paired with a product to sell. (Only antennas of the same type and with equal or less gains as shown below may be used with the The Bluetooth module. Other types of antennas and/or higher gain antennas may require additional uthorization for operation)

Module operation

1. According to the following requirements of the power supply, power up, about 3 seconds to to complete the initial。

2. Iphone/Android mobile phone BT function to open, search to the corresponding Bluetooth module name (name can be changed according to customer production requirements), click the name of the BT and select the connection.

3. open application software (need to install the company's specific application software development, application software interface can be customized according to customer's product requirements), click on the interface to see the scene。
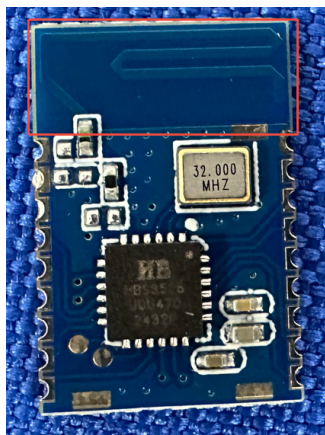
Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

Conditions on using SHENZHEN NEWBIT INFO TECHNOLOGY CO.,LTD regulatory approvals:
A. A user's manual or instruction manual must be included with the customer product that contains the text as required by applicable law. Without limitation of the foregoing, an example (for illustration purposes only) of possible text to include is set forth below:

List of applicable FCC rules and RSS rules
FCC Part 15 Subpart C 15.247 & 15.207 & 15.209& 15.205

Specific operational use conditions
Operation Frequency:2402~2480MHz
Number of Channel:40 Channels
Modulation Type:GFSK
Antenna Type:PCB antenna
Antenna Gain(Peak): -0.5 dBi (Provided by customer)
The module can be used for mobile or portable applications with a maximum -0.5 dBi antenna. The holder of certificate installing this module into their product must ensure that the final composit product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation. The holder of certificate 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.

Limited module procedures
Applicable. The product does not have a shielding cover and an independent power supply. This module is for restricted use and meets the requirements of FCC Part 15.212.

Sales method: Selling modules separately in the form of materials.
Module installation precautions: The module installation adopts SMT (Surface Mount Technology) technology, which is welded on the surface of the product. Attention should be paid to the applicable voltage range of DC1.8~3.6V for the matching circuit, and the solder joints of the data communication interface should be firm. It is necessary to confirm that the module ground and product ground are the same. If the terminal is equipped with multiple antennas (such as Bluetooth+WLAN), it is necessary to ensure that each antenna does not interfere with each other when coexisting.

Note: The new host configuration requires the assignee (not the host integrator) to submit a Class II Change application. Integration instructions: The host integrator's technical license requires contacting the assignee to submit a license change application.

Contact information of the assignee:
Name: Sherry Zhou
Position: Manager
Company Name: SHENZHEN NEWBIT INFO TECHNOLOGY CO.,LTD.
Address: Room 1616, Global Logistics Center Building, Longgang Dist, Shenzhen, China
Tel: 13168086680
Email: 616874949@qq.com

RF exposure considerations

The device can be used in portable exposure condition without restriction and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the holder of certificate will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

Information on test modes and additional testing requirements：

The working tempeature range of the module is: -40~85℃
The working voltage range of the module is: DC 1.8V~3.6V
If the module experiences overvoltage or undervoltage, or if the temperature is too low or too high, it will stop working, There is no risk of interference.

Operation Frequency:2402~2480MHz
Number of Channel:40 Channels
Modulation Type:GFSK
Rate   : 1Mbps/2Mbps
Antenna Type: PCB antenna
Antenna Gain(Peak):-0.5dBi (Provided by customer)

The test mode can be the worst mode in the original report: GFSK 1Mbps 2402MHz.
Note: The maximum power of the module is 4 ± 1dBm.   The product uses a fixed onboard antenna and does not involve antenna replacement.

holder of certificate must perfom test of radiated & conducted emission and spurious emission, etc according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.
Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

The fixed frequency installation is arranged as follows:

1. Overview

The 6621 series chips support two RF test interfaces (HCI and DTM 2-wire UART) specified by the BT specification. This article mainly introduces the HCI test interface. The HCI test interface connection method is as follows:

(1) Connect TX to serial port RX on the EVB motherboard;

(2) Connect RX to serial port TX on the EVB motherboard;

(3) Connect GND on the EVB motherboard to the serial port GND;

(4) Connect VBAT to the positive pole of the power supply on the EVB motherboard;

(5) Connect the GND of the EVB motherboard to the negative pole of the power supply;

(6) VBAT provides a 3.3V voltage supply. (The serial port is first plugged into the computer, and then the power supply is used to power the chip to prevent reverse power from the serial port to the chip end.)

This software should use the same UART interface settings as the chip for communication. The UART port parameters are as follows:

（1） Baud rate: 115200

（2） Data bit：8

（3） Stop bit：1

（4） Paritybit：None

2 Instrument Connection

The connection between the RF authentication testing tool, 6621 series chip, and RF testing instrument is shown in Figure 2-1. The RF testing instrument port is connected to the RF IO of the 6621 series chip through an RF cable, and the UART of the PC (RF authentication testing tool) is connected to the UART interface of the 6621 series chip.
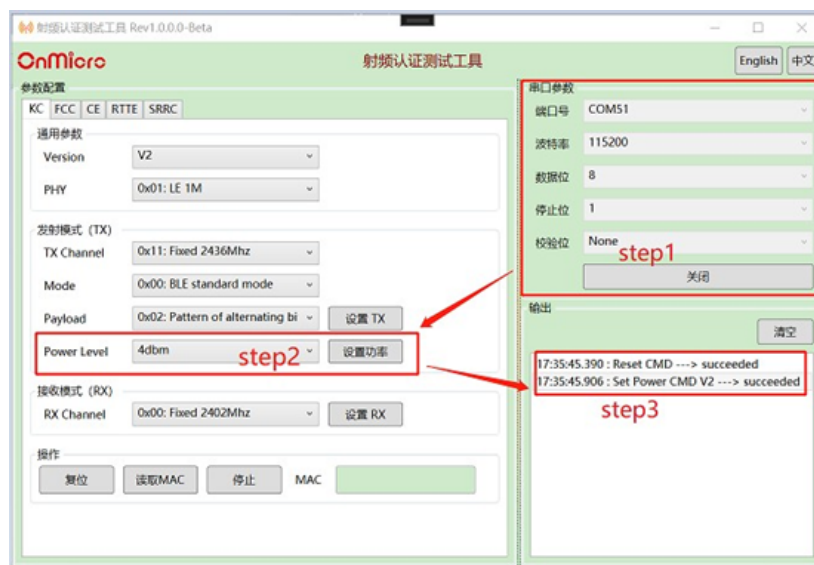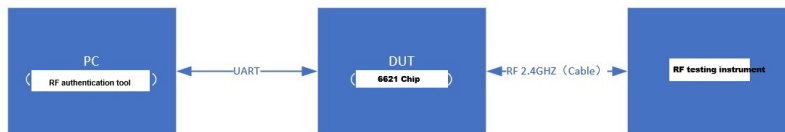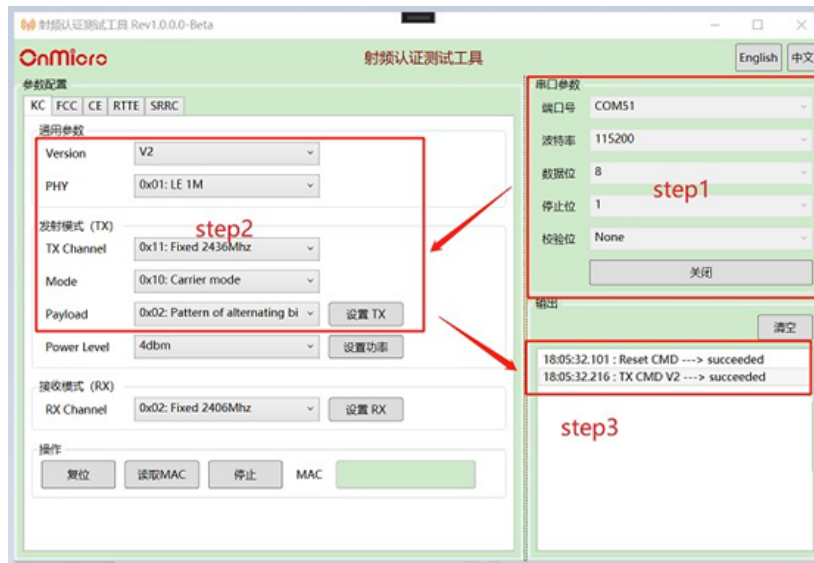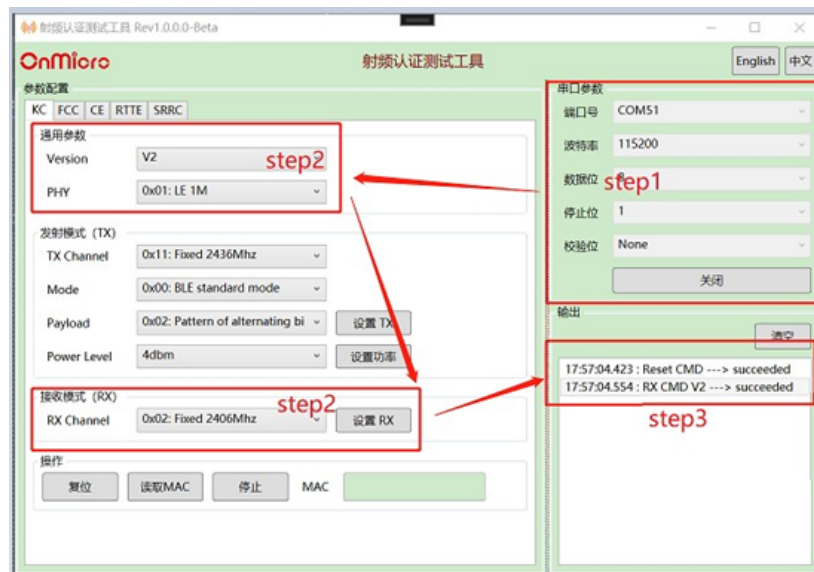
TX mode

RX mode

FCC Test Plan

This module does not include shielding and independent power supply, therefore it is limited. The assignee will need to submit Class II license changes for each host specific installation. This should undergo the following tests to demonstrate ongoing compliance.

TABLE OF CONTENTS

1. Summary Of Standards And Results

1.1. Description of Standards and Results

The EUT have been tested according to the applicable standards as referenced below:

Test Item	Standards Paragraph	Result
Conducted Emission	FCC Part 15: 15.207 ANSI C63.10 :2013	
6dB Bandwidth	FCC PART 15:15.247(a)(2) ANSI C63.10 :2013	
Output Power	FCC Part 15: 15.247(b)(3) ANSI C63.10 :2013	
Radiated Spurious Emission	FCC Part 15: 15.209 FCC Part 15: 15.247(d) ANSI C63.10 :2013	
Conducted Spurious & Band Edge Emission	FCC Part 15: 15.247(d) ANSI C63.10 :2013	
Power Spectral Density	FCC PART 15:15.247(e) ANSI C63.10 :2013	
Radiated Band Edge Emission	FCC Part 15: 15.247(d) , ANSI C63.10 :2013	
Antenna Requirement	FCC Part 15: 15.203	

Note: 1. P is an abbreviation for Pass.

2. F is an abbreviation for Fail.

3. N/A is an abbreviation for Not Applicable.

4. Conclusion determination rules of this report: Unless there are clear provisions on measurement uncertainty in the standard or customer requirements, decision by actual test data without considering measurement uncertainty.

5. Measurement method usage KDB 558074 D01 15.247 Meas Guidance v05r02.

2. General Information

2.1. Description of Device (EUT)

Product Name	:	BLE Transmission Modules
Model No.	:	MX-01P, MX-35A, MX-02P
Diff	:	There is no difference except the name of the model.
Power supply	:	DC 1.8~3.6V
Note		If the module stops working under undervoltage or overvoltage, under heat or overheating, this will be considered acceptable. Maximum operating voltage: DC 1.8V Small operation voltage: DC 3.6V

Radio Technology	:	Bluetooth V5.1 LE
Operation frequency	:	2402-2480MHz
Channel No.	:	40 channels
Channel Separation	:	2MHz
Rate	:	1Mbps/2Mbps
Modulation	:	GFSK
Antenna Type	:	PCB antenna, maximum gain is -0.5dBi.
PMN	:	N/A
HVIN	:	N/A
Software version	:	V1.0
Hardware version/FVIN	:	V1.0

2.2. Accessories of Device (EUT)

Accessories 1	:	USB cable
Manufacturer	:	N/A
Model	:	N/A
Rating	:	N/A

2.3. Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number
1	USB to TTL	Yunxin	CH340G	N/A
2	Notebook PC	Dell	Latitude 3490	N/A

2.4. Block Diagram of Connection Between EUT and Simulators

CE:

Notebook PC ⟶ EUT

RSE:

Notebook PC ⟶ EUT
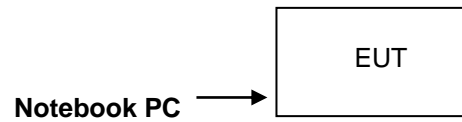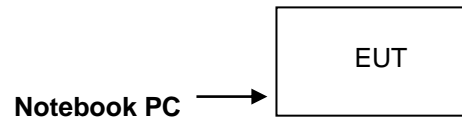
2.5. Test Mode Description

The test software was used to control EUT work in Continuous TX mode, and select test channel, wireless mode

Tested mode, channel, and data rate information		
Mode	Channel	Frequency (MHz)
GFSK Tx Mode 1Mbps/2Mbps	CH0	2402
	CH19	2440
	CH39	2480

Channel list:					
Channel	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**
CH0	2402	CH14	2430	CH28	2458
CH1	2404	CH15	2432	CH29	2460
CH2	2406	CH16	2434	CH30	2462
CH3	2408	CH17	2436	CH31	2464
CH4	2410	CH18	2438	CH32	2466
CH5	2412	CH19	2440	CH33	2468
CH6	2414	CH20	2442	CH34	2470
CH7	2416	CH21	2444	CH35	2472
CH8	2418	CH22	2446	CH36	2474
CH9	2420	CH23	2448	CH37	2476
CH10	2422	CH24	2450	CH38	2478
CH11	2424	CH25	2452	CH39	2480
CH12	2426	CH26	2454	--	--
CH13	2428	CH27	2456	--	--

2.6. Software test version and power setting information

Software testing version	RF_Test.exe REV 1.0.0.0		
Mode	The client 's preset testing software is used to control the operation of EUT in continuous transmission mode and select the testing channel, wireless mode:		
Power level setup by client			
Mode	Channel	Frequency (MHz)	Soft Set
GFSK Tx Mode 1Mbps/2Mpbs	CH0	2402	TX level is set as defaults value.
	CH19	2440	TX level is set as defaults value.
	CH39	2480	TX level is set as defaults value.

3. Spurious Emission

3.1. Test Limits

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

15.205 Restricted frequency band

| MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])

15.209 Limit

| FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
0.009-0.490	300	2400/F(KHz)	/
0.490-1.705	30	24000/F(KHz)	/
1.705-30	30	30	29.5
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

Note: The peak limit is 20 dB higher than the average limit

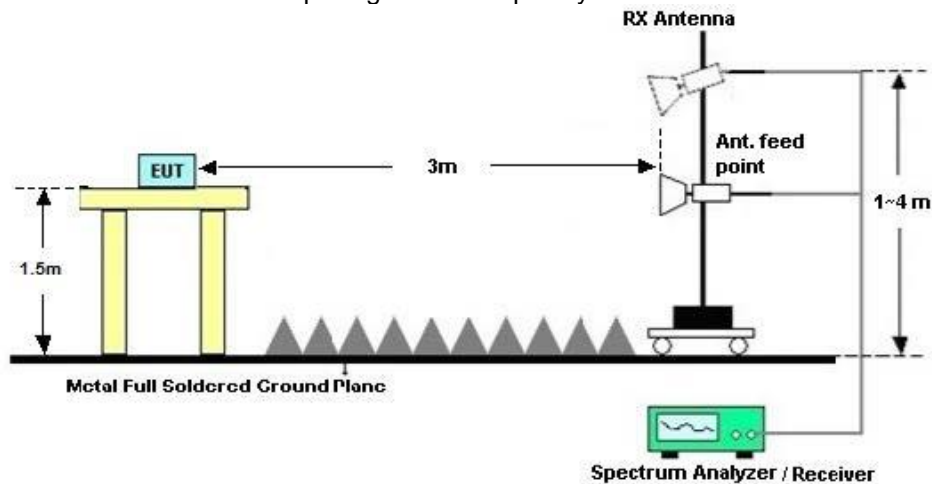## 3.2. Block Diagram of Test setup

3.2.1 In 3m Anechoic Chamber Test Setup Diagram for below 30MHz
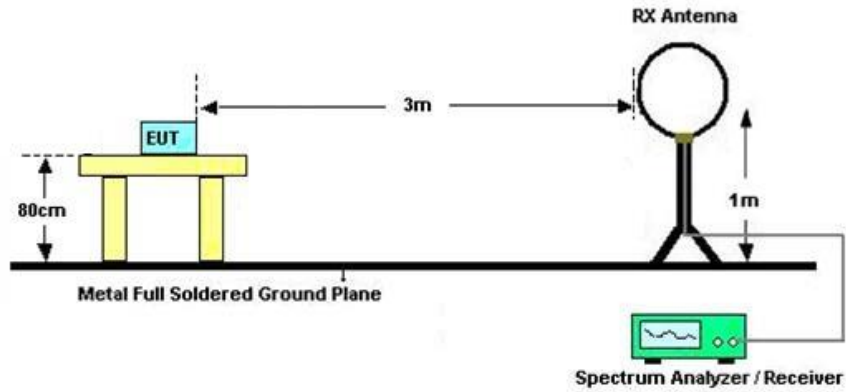
3.2.2 In 3m Anechoic Chamber Test Setup Diagram for below 1GHz
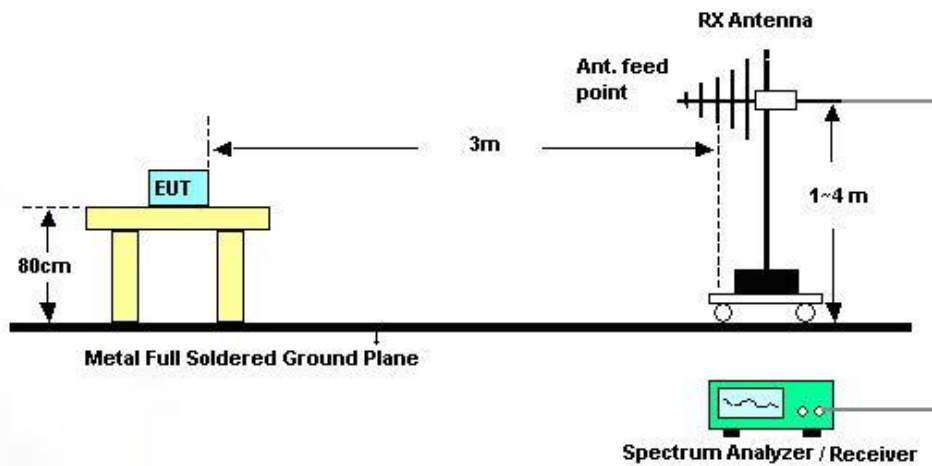
3.2.3 In 3m Anechoic Chamber Test Setup Diagram for frequency above 1GHz

3.3. Test Procedure

(1) EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber.

(2) Setup EUT and simulator

(3) Test antenna was located 3m from the EUT on an adjustable mast. Below pre-scan procedure was first performed in order to find prominent radiated emissions.

(a) Change work frequency or channel of device if practicable.

(b) Change modulation type of device if practicable.

(c) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions

(4) Spectrum frequency from 9KHz to 25GHz (tenth harmonic of fundamental frequency) was investigated

(5) For final emissions measurements at each frequency of interest, the EUT were rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10:2013on Radiated Emission test.

(6) For emissions above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the BW is set at 1MHz, VBW is set at 3MHz for Peak measure; RBW is set at 1MHz, VBW is set at 10Hz for Average easure.

st setup information:

9KHz~150KHz	RBW200Hz	VBW1KHz
150KHz~30MHz	RBW9KHz	VBW 30KHz
30MHZ~1GHz	RBW120KHz	VBW 300KHz
Above1GHz	RBW1MHz	VBW 3MHz

3.4. Test Data

4. Power Line Conducted Emission

4.1. Test Limits

Frequency	Limits dB(μV)	
MHz	Quasi-peak Level	Average Level
0.15 -0.50	66 -56*	56 - 46*
0.50 -5.00	56	46
5.00 -30.00	60	50

Notes: 1. *Decreasing linearly with logarithm of frequency.
2. The lower limit shall apply at the transition frequencies.
3. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

4.2. Test Procedure

The EUT is put on the plane 0.8m high above the ground by insulating support and is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs.
Both sides of AC lines are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to ANSI C63.10:2013 on Conducted Emission Measurement.
The bandwidth of test receiver is set at 9 kHz.

4.3. Test Setup
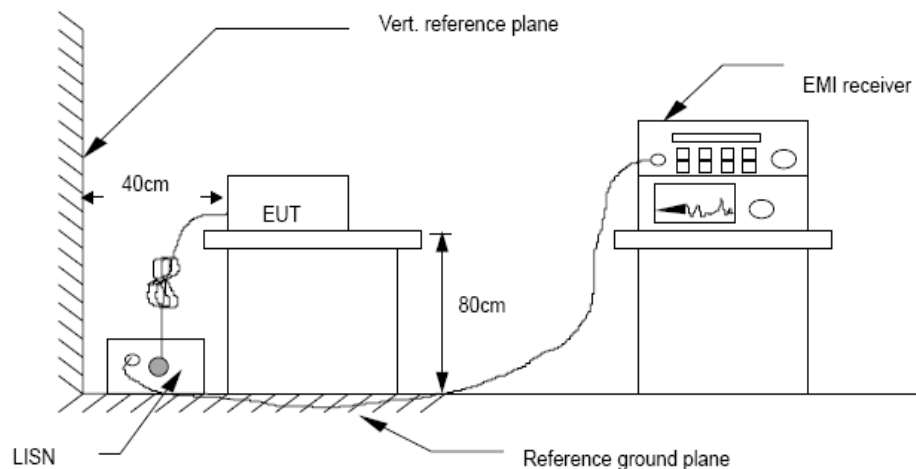
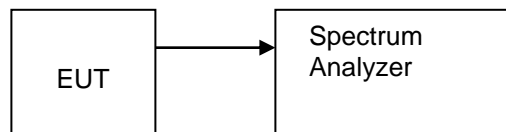## 4.4. Test Data

5. Out-of-band Emissions

5.1. Test Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in FCC Part 15.209(a) is not required.
Please refer section 15.247.

5.2. Test Procedure

Connect the transmitter ouput to spectrum analvzer using a low loss RF cable, and set the spectrum analvzer to RBW=100 kHz, VBW= 300 kHz, peak detector, and max hold. Measurements utilizing these setting are made of the in-band reference level, bande dge and out-of-band emissions.

5.3. Test Setup

```
┌──────────┐          ┌──────────────┐
│          │          │  Spectrum    │
│   EUT    │─────────▶│  Analyzer    │
│          │          │              │
└──────────┘          └──────────────┘
```

5.4. Test Data

6. Conducted Maximum Output Power

6.1. Test limits

Please refer FCC PART 15: 15.247.

Regulation 15.247(b) The limit of Maximum Peak Output Power Measurement is 1 W(30dBm)

6.2. Test Procedure

Details see the KDB558074 D01 Meas Guidance v05r02

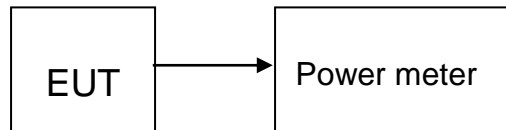1 Place the EUT on the table and set it in transmitting mode.

2 Connected the EUT's antenna port to peak power meter by 20dB attenuator.

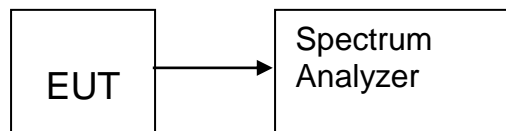3 Measure out each mode and each bands Peak output power of EUT.

Note: The cable loss and attenuator loss were offset into measure device as amplitude offset.

6.3. Test Setup

Conducted Power:

Duty cycle:

6.4. Test Data
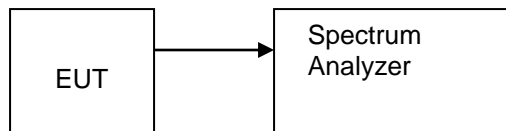
7. Peak Power Spectral Density

7.1. Test limits

1 Please refer FCC PART 15.247.

2 For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

3 The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

7.2. Test Procedure

Details see the KDB558074 D01 Meas Guidance v05r02

1 Place the EUT on the table and set it in transmitting mode.

2 Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

3 Set the spectrum analyzer as RBW = 3kHz(Set the RBW to: 3 kHz≤RBW≤100 kHz.), VBW = 10kHz(Set the VBW≥3×RBW), span≥1.5×DTS bandwidth., detail see the test plot.

4 Record the max reading.

5 Repeat the above procedure until the measurements for all frequencies are completed.

7.3. Test Setup

```
┌──────────┐          ┌──────────────┐
│          │          │  Spectrum    │
│   EUT    │─────────▶│  Analyzer    │
│          │          │              │
└──────────┘          └──────────────┘
```

7.4. Test Data

8. Bandwidth

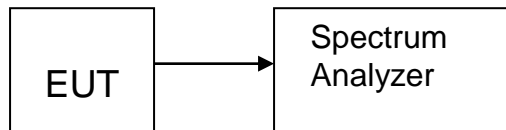## 8.1. Test limits

Please refer FCC PART 15.247
For direct sequence systems, the minimum 6dB bandwidth shall be at least 500 kHz.

8.2. Test Procedure

Details see the KDB558074 D01 Meas Guidance v05r02
a) The bandwidth is measured at an amplitude level reduced 6dB from the reference level. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.
b) The test receiver set RBW = 100kHz, VBW≥3*RBW =300kHz,, Peak Detector, Sweep time set auto, detail see the test plot.
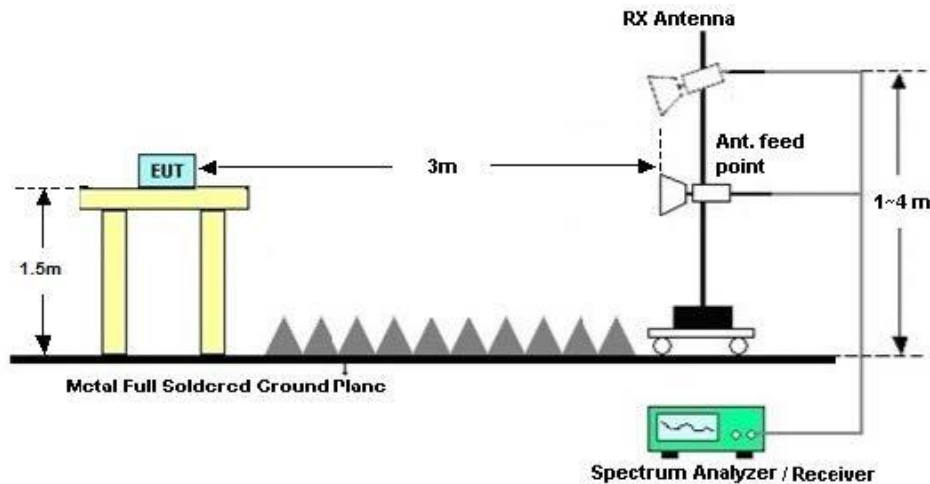
8.3. Test Setup

```
┌──────────┐        ┌──────────────┐
│          │        │  Spectrum    │
│   EUT    │───────▶│  Analyzer    │
│          │        │              │
└──────────┘        └──────────────┘
```

8.4. Test Data

9. Band Edge Test

9.1. Block Diagram of Test Setup

9.2. Test Limit

radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c))

Please refer section 15.247.

9.3. Test Procedure

Refer to ANSI C 63.10, Clause 6.10.
All restriction band and non- restriction band have been tested, only worse case is reported.
Details see the KDB558074 D01 Meas Guidance v05r02

1. Put the EUT on a 0.1m high table, power on the EUT. Emissions were scanned and measured rotating the EUT to 360 degrees, Find the maximum Emission
2. Check the spurious emissions out of band.
3. RBW 1MHz, VBW 3MHz, peak detector for peak value, RBW 1MHz, VBW 10Hz, RMS detector for AV value.

9.4. Test Data

10. Antenna Requirement

10.1. Standard Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

10.2. Antenna Connected Construction

The antenna connector is unique antenna and no consideration of replacement. Please see EUT photo for details.

10.3. Results

The EUT antenna is PCB antenna. It complies with the standard requirement.