

FRX-M88CU-22

802.11ac 867Mbps WLAN+ Bluetooth v5.0

USB2.0 Module Specification

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Module Name: FRX-M88CU-22

Module Type: 802.11a/b/g/n/ac 867Mbps WLAN + Bluetooth v5.0 Combo USB2.0 Module

Revision: V1.0

Customer Approval:

Company:

Title:

Signature:

Date:

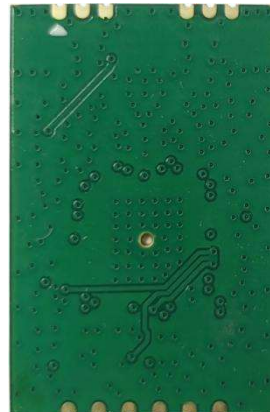
Title:

Signature:

Date:



(Top View)



(Bottom View)

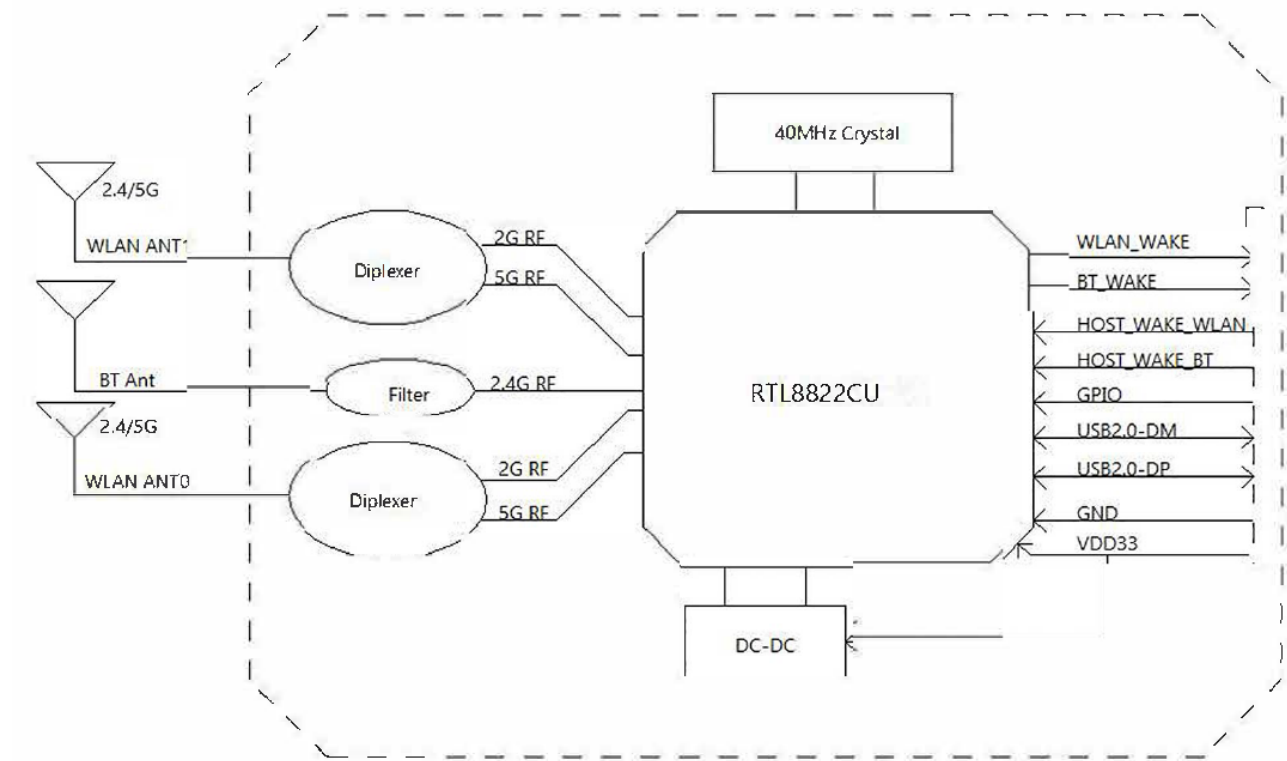
1. Introduction

FRX-M88CU-22 is a highly integrated Dual-band WLAN + Bluetooth v5.0 Combo module. It combines a 2T2R Dual-band WLAN subsystem and a Bluetooth v5.0 subsystem. This module compatible with IEEE 802.11a/b/g/n/ac standard and provides the maximum PHY rate up to 867Mbps, it supports BT / BLE dual mode with BT v5.0/v4.2/v2.1 compliant, offering feature-rich wireless connectivity at high standards, and delivering reliable, cost-effective throughput from an extended distance.

1.1 Features

- Operating Frequency: 2.4~2.4835GHz or 5.15~5.85GHz
- Support Dual-band 2T2R mode with 20/40/80Mhz bandwidth
- Wireless PHY rate can reach up to 867Mbps
- Support BT Classic / BT Low Energy dual mode
- Support Bluetooth v5.0 system
- Connect to external antennas through IPEX

1.2 Block Diagram



1.3 General Specifications

Module Name	FRX-M88CU-22
Chipset	RTL8822CU-CG
WLAN Standards	IEEE802.11a/b/g/n/ac
Bluetooth Standards	Bluetooth Core Specification v5.0/v4.2/v2.1
Host Interface	USB2.0 interface for WLAN & Bluetooth
Antenna	Connect to external antennas through IPEX connectors
Dimension	SMD 32Pins, 27*18*2.2mm (L*W*H), Tolerance: +/-0.15mm
Power Supply	DC 3.3V±0.2V@ 1200 mA(Max)
Operation Temperature	-20°C to +70°C
Operation Humidity	10% to 95% RH (Non-Condensing)

2. Pin Assignments

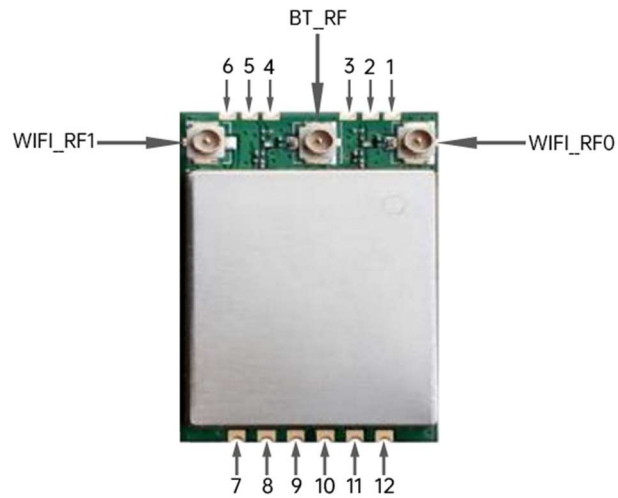


Figure 4 Pin Assignments (Top view)

Pin No:	Pin Name	Type	Description
1	GND	P	GND
2	RF0	I/O	WIFI RF port0 (NC)
3	GND	P	GND
4	GND	P	GND
5	RF1	I/O	WIFI RF port1 (NC)
6	GND	P	GND
7	LED	I/O	LED signal pin(not use)
8	GND	P	GND
9	DP+	I/O	USB differential data line
10	DM-	I/O	USB differential data line
11	3.3V	P	Power supply
12	PDN	I/O	Reset signal pin (active low)

3. Electrical and Thermal Specifications

3.1 Recommended Operating Conditions

Parameters		Min	Typ	Max	Units
Ambient Operating Temperature		-20	25	70	°C
External Antenna VSWR			1.7	2.0	/
Supply Voltage	3.3V	3.1	3.3	3.5	V

3.2 Digital I/O DC Specifications

Symbol	Parameter	Min	Typ	Max	Units
VIH	Input High Voltage	2.0	3.3	3.6	V
VIL	Input Low Voltage	--	0	0.9	V
VOH	Output High Voltage	2.97	--	3.3	V
VOL	Output Low Voltage	0	--	0.33	V

3.3 Current Consumption

Conditions : VDD33=3.3V ; Ta:25°C ;			
Use Case	VDD33 Current		
	Typ(I _{RMS})	Max(I _{peak})	Units
WLAN Unassociated (Linux Driver) 2.4G	186	220	mA
WLAN Unassociated (Linux Driver) 5G	189	236	mA
2.4G WLAN TCP throughput TX 200Mbps (Linux Drive, BT disable)	379	540	mA
5G WLAN TCP throughput TX 260Mbps (Linux Drive, BT disable)	424	700	mA
2.4G 11b@1Mbps TX @18dBm (1TX RF test)	400	420	mA
2.4G 11b@11Mbps TX @18dBm (1TX RF test)	402	460	mA
2.4G 11n@HT20_MCS8 TX@16dBm (2TX RF test)	529	820	mA
2.4G 11n@HT20_MCS8 RX (2RX RF test)	226	231	mA
2.4G 11n@HT40_MCS15 TX@16dBm (2TX RF test)	390	1080	mA
2.4G 11n@HT40_MCS15 RX (2RX RF test)	212	260	mA
5G 11a@6Mbps TX @17dBm (1TX RF test)	417	520	mA
5G 11a@6Mbps RX (1RX RF test)	208	240	mA

5G 11ac@VHT20_MCS8 TX@15dBm (2TX RF test)	650	1000	mA
5G 11ac@VHT20_MCS8 RX (2RX RF test)	212	260	mA
5G 11ac@VHT80_MCS9 TX@14dBm (2TX RF test)	250	400	mA
5G 11ac@VHT80_MCS9 RX (2RX RF test)	211	230	mA

4. WLAN & Bluetooth RF Specification

4.1 2.4G WLAN RF Specification

Conditions : VDD33=3.3V ; Ta:25°C	
Features	Description
WLAN Standard	IEEE 802.11b/g/n
Frequency Range	2.4~2.4835GHz (2.4GHz ISM Band)
Channels	CE:Ch1~Ch13 (For 20MHz Channels) FCC:Ch1~Ch11 (For 20MHz Channels)
Modulation	802.11b DSSS: CCK, DQPSK, DBPSK 802.11g OFDM: 64QAM, 16QAM, QPSK, BPSK 802.11n OFDM: 64QAM, 16QAM, QPSK, BPSK
Date Rate	802.11b: 1, 2, 5.5, 11Mbps, 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps ; 802.11n (HT20) : MCS0~MCS7(1T1R_SISO) 6.5~72.2Mbps ; 802.11n (HT20) : MCS8~MCS15(2T2R_MIMO) 13~144.4Mbps ; 802.11n (HT40) : MCS0~MCS7(1T1R_SISO) 13.5~150Mbps ; 802.11n (HT40) : MCS8~MCS15(2T2R_MIMO) 27~300Mbps ;
Frequency Tolerance	$\leq \pm 20\text{ppm}$

802.11n@HT40_MCS7	Calibrated TX Power =16dBm	±2dBm	≤-28
2.4G Receiver Specifications (WLAN_ANT0&WLAN_ANT1)			
RX Rate	Min Input Level(Typ)	Max Input Level(Typ)	PER
802.11b@1Mbps	-94dBm	-10dBm	< 8%
802.11b@11Mbps	-86dBm	-10dBm	< 8%
802.11g@6Mbps	-88dBm	-10dBm	< 10%
802.11g@54Mbps	-74dBm	-10dBm	< 10%
802.11n@HT20_MCS0	-86dBm	-10dBm	< 10%
802.11n@HT20_MCS7	-70dBm	-10dBm	< 10%
802.11n@HT40_MCS0	-84dBm	-10dBm	< 10%
802.11n@HT40_MCS7	-68dBm	-10dBm	< 10%

4.2 5G WLAN RF Specification

Conditions : VDD33=3.3V ; Ta:25°C	
Features	Description
WLAN Standard	IEEE 802.11a/n/ac
Frequency Range	5.15~5.25GHz ; 5.25~5.35GHz ; 5.47~5.73GHz ; 5.735~5.835GHz (5GHz ISM Band)
Channels	Ch36 , Ch40 , Ch44 , Ch48 ; Ch52~Ch64 ; Ch100~Ch140 ; Ch149~Ch165 (For 20MHz Channels)
Modulation	802.11a (OFDM) : BPSK , QPSK , 16QAM , 64QAM ; 802.11n (OFDM) : BPSK , QPSK , 16QAM , 64QAM ; 802.11ac (OFDM) : BPSK , QPSK , 16QAM , 64QAM , 256QAM ;

Date Rate	802.11a: 6 , 9 , 12 , 18 , 24 , 36 , 48 , 54Mbps ; 802.11n (HT20) : MCS0~MCS7(1T1R_SISO) 6.5~72.2Mbps ; 802.11n (HT20) : MCS8~MCS15(2T2R_MIMO) 13~144.4Mbps ; 802.11n (HT40) : MCS0~MCS7(1T1R_SISO) 13.5~150Mbps ; 802.11n (HT40) : MCS8~MCS15(2T2R_MIMO) 27~300Mbps ; 802.11ac (VHT20) : MCS0~MCS8(1T1R_SISO) 6.5~86.7Mbps ; 802.11ac (VHT20) : MCS0~MCS8(2T2R_MIMO) 13~173.3Mbps ; 802.11ac (VHT40) : MCS0~MCS9(1T1R_SISO)13.5~200Mbps ; 802.11ac (VHT40) : MCS0~MCS9(2T2R_MIMO)27~400Mbps ; 802.11ac (VHT80) : MCS0~MCS9(1T1R_SISO)29.3~433.3Mbps ; 802.11ac (VHT80) : MCS0~MCS9(2T2R_MIMO)58.5~866.7Mbps ;
Frequency Tolerance	$\leq \pm 20\text{ppm}$

5G Receiver Specifications (WLAN_ANT0&WLAN_ANT1)			
RX Rate	Min Input Level(dBm)	Max Input Level(dBm)	PER
802.11a@6Mbps	-88dBm	-10dBm	< 10%
802.11a@54Mbps	-74dBm	-10dBm	< 10%
802.11n@HT20_MCS0	-86dBm	-10dBm	< 10%
802.11n@HT20_MCS7	-70dBm	-10dBm	< 10%
802.11n@HT40_MCS0	-84dBm	-10dBm	< 10%
802.11n@HT40_MCS7	-68dBm	-10dBm	< 10%
802.11ac@VHT20_MCS8	-66dBm	10dBm	< 10%
802.11ac@VHT40_MCS9	-65dBm	-10dBm	< 10%
802.11ac@VHT80_MCS0	-83dBm	-10dBm	< 10%
802.11ac@VHT80_MCS9	-58dBm	-10dBm	< 10%

4.3 Bluetooth RF Specification

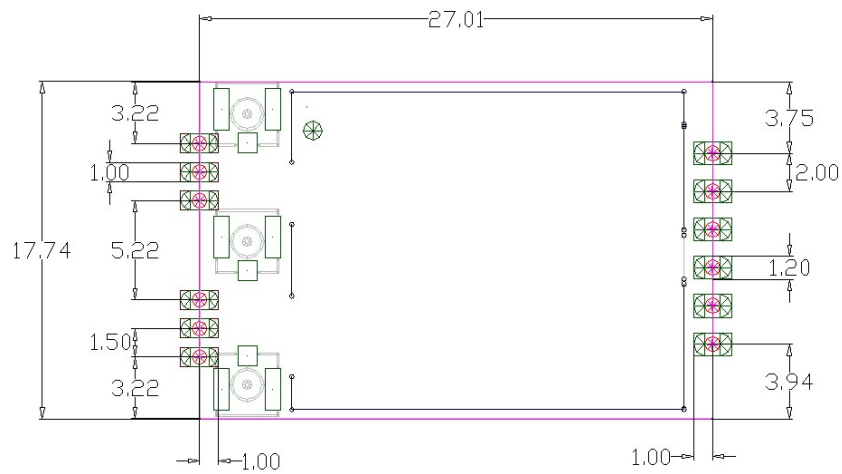
Conditions: VDD33=3.3V; Ta:25°C	
Features	Description
Bluetooth Specification	Bluetooth Core Specification v5.0/4.2/2.1
Frequency Range	2.4~2.4835GHz (2.4GHz ISM Band)
Channels	Bluetooth Classic: Ch0~Ch78 (For 1MHz Channels); Bluetooth Low Energy: Ch0~Ch39 (For 2MHz Channels);
Power Classes	Bluetooth Classic BR/EDR: Class1; Bluetooth Low Energy: Class1.5;
Date Rate & Modulation	BR_1Mbps: GFSK; EDR_2Mbps: $\pi/4$ -DQPSK; EDR_3Mbps: 8DPSK LE_1Mbps: GFSK (Uncoded);

Items	Min	Typ	Max
BR_1M (DH1) Modulation Characteristics			
Δf_{1avg}	140KHz	170.5kHz	175KHz
Δf_{2avg}	115KHz	141.5kHz	175KHz
Δf_{2max}	115KHz	164.1kHz	/
$\Delta f_{2avg}/\Delta f_{1avg}$	0.8	0.829	/
BR_1M (DH1) Initial Carrier Frequency Tolerance			
Init Freq Error	-75kHz	6.5kHz	+75kHz
EDR_3M(3DH5) EDR Carrier Frequency Stability and Modulation Accuracy			
ω_i	-75KHz	4.94KHz	+75KHz
$\omega_i + \omega_o$	-75KHz	6.41KHz	+75KHz
ω_o	-10KHz	1.51KHz	+10KHz
8DPSK RMS DEVM	/	0.166	0.13
8DPSK DEVM	/	0.262	0.25
LE_1M Modulation Characteristics			
Δf_{1avg}	225KHz	249.95KHz	275KHz
Δf_{2avg}	225KHz	227.64KHz	275KHz
Δf_{2max}	185KHz	201.26KHz	/
$\Delta f_{2avg}/\Delta f_{1avg}$	0.8	0.91	/

Bluetooth Receiver Specifications (BT_ANT)				
Items	Sensitivity		Maximum Input Level	
	Input Level(Typ)	BER	Input Level(Typ)	BER
BR_1M(1DH1)	-92dBm	≤0.1%	-5dBm	≤0.1%
EDR_2M(2DH1)	-90dBm	≤0.01%	-5dBm	≤0.1%
EDR_3M(3DH5)	-80dBm	≤0.01%	-5dBm	≤0.1%
	Input Level (Typ)	PER	Input Level (Typ)	PER
LE_1M	-92dBm	≤5%	-5dBm	≤5%

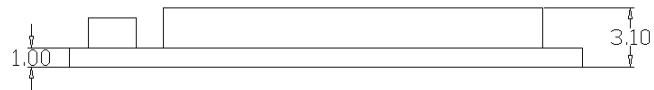
5. Mechanical Specifications

5.1 Module Outline Drawing



Module dimension: Typical (L*W * H): 27*17.7*3.1mm (L*W*H) , Tolerance: ± 0.15 mm

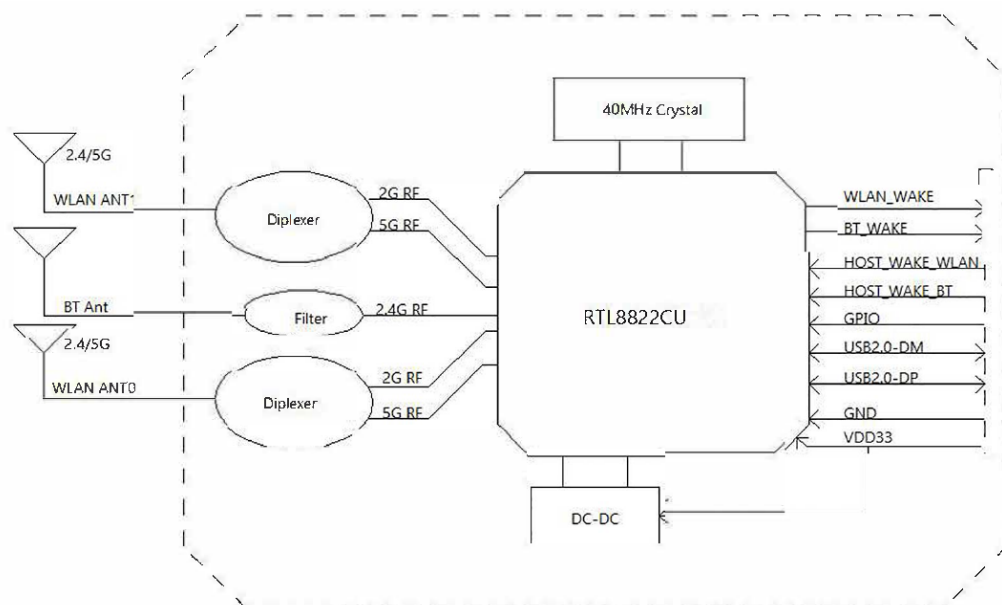
IPEX / MHF-1 connector dimension: 3.0*2.6*1.2mm (L*W*H, $\varnothing 2.0$ mm)



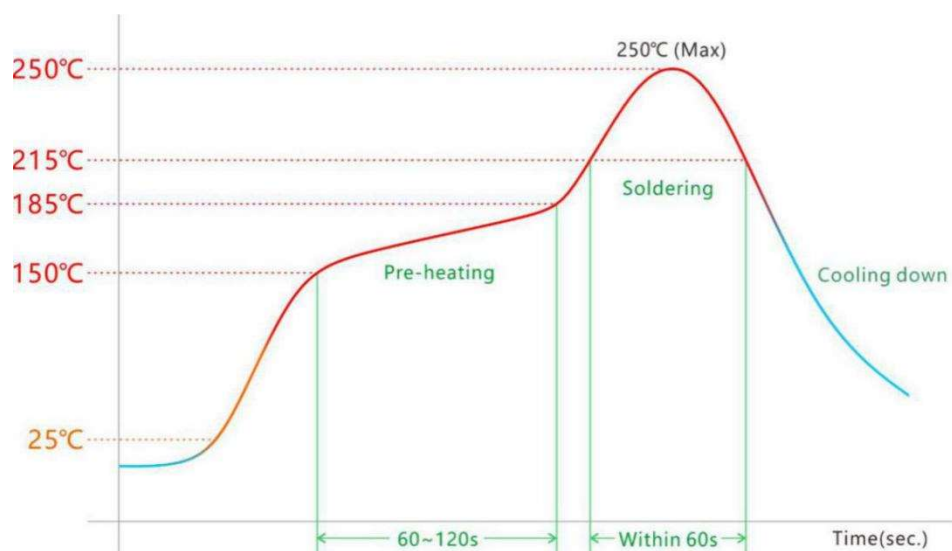
Module Bow and Twist: ≤ 0.1 mm

6. Application Information

6.1 Typical Application Circuit



6.2 Reflow Soldering Standard Conditions



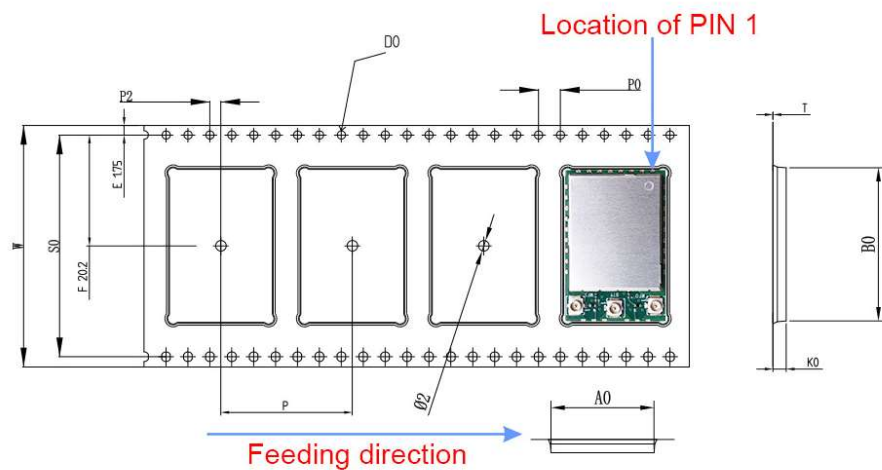
Please use the reflow within 2 times.
Set up the highest temperature within 250°C.

7. Key Components Of Module

No.	Parts	Specification	Manufacturer	Note
1	Chipset	RTL8822CU-CG	Realtek	
2	PCB	FRX-M88CU-22	Shen Zhen Tie Fa Technology limited	
			Million Source Printed Circuit Board Co., Ltd	
			Quzhou Sunlord Electronics Co., Ltd	
3	Crystal	40MHz-3225	ZheJiang East Crystal Electronic Co.,Ltd.	
			Lucki Electronics Co., Ltd	
			Chengde Oscillator Electronic Technology Co., Ltd.	
4	Diplexer	DP1608	HEK	
			Advanced Ceramic X	

8. Package and Storage Information

8.1 Package Dimensions



ITEM	W	A0	B0	K0	E	F	P	P0	P2	D0	T
DIM	44.00±0.3	18.40±0.1	27.40±0.1	2.50±0.1	1.75±0.1	20.2±0.1	24.00±0.1	4.00±0.1	2.00±0.1	Ø1.5±0.1	0.35±0.05

Package specification:

1. 1,000 modules per roll and 4,000 modules per box.
2. Outer box size: 37.5*36*29cm.
3. The diameter of the blue environment-friendly rubber plate is 13 inches, with a total thickness of 48mm (with a width of 44mm carrying belt).
4. Put 1 package of dry agent (20g) and humidity card in each anti-static vacuum bag.
5. Each carton is packed with 4 boxes.

8.2 Storage Conditions

Absolute Maximum Ratings:

Storage temperature: -40°C to +85°C

Storage humidity: 10% to 95% RH (Non-Condensing)

Recommended Storage Conditions:

Storage temperature: 5°C to +40°C

Storage humidity: 20% to 90% RH

Please use this Module within 12month after vacuum-packaged.

The Module shall be stored without opening the packing.

After the packing opened, the Module shall be used within 72hours.

When the color of the humidity indicator in the packing changed,

The Module shall be baked before soldering.

Baking condition: 60°C, 24hours, 1time.

ESD Sensitivity:

ESD Protection: 2KV(HBM ,Maximum rating)

The Module is a static-sensitive electronic device.

Do not operate or store near strong electrostatic fields.

Take proper ESD precautions!



ESD CAUTION

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.

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 modular has been tested and found to comply with part 15 requirements for Modular Approval.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01r01

2.2 List of applicable FCC rules

CFR 47 FCC Part 15 Subpart C and Subpart F has been investigated. It is applicable to the modular transmitter

2.3 Specific Operational Use Conditions - Antenna Placement Within the Host Platform

The module is tested for standalone mobile RF exposure use condition.

- The antenna must be installed such that 20cm is maintained between the antenna and users,
- The transmitter module may not be co-located with any other transmitter or antenna.

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.

2.4 Limited Module Procedures

Not applicable

2.5 Trace Antenna Designs

Not applicable

2.6 RF Exposure Considerations

This device 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 Antenna Type and Gain

The following antennas have been certified for use with this module.

Only antennas of the same type with equal or lower gain may also be used with this module.

Other types of antennas and/or higher gain antennas may require the additional

authorization for operation.

Antenna Specification list below:

Model	Type	Connector	Peak gain (dBi)				
			2400-2483.5	5150-5250	5250-5350	5470-5725	5725-5850
			MHz	MHz	MHz	MHz	MHz
FRX-M88CU-22	External Antenna	/	2.00dBi	2.00dBi	2.00dBi	2.00dBi	2.00dBi

2.8 End Product Labelling Compliance Information

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily removed. If not, a second label must be placed on the outside of the final device that contains the following text: “Contains FCC ID: **2AVEDFRX-M88CU-22**” . The FCC ID can be used only when all FCC compliance requirements are met.

2.9 Information on Test Modes and Additional Testing Requirements

This transmitter is tested in a standalone mobile RF exposure condition and any co-located or simultaneous transmission with other transmitter(s) class II permissive change re-evaluation or new FCC authorization.

Host manufacturer installed this modular with single modular approval should perform the test of radiated emission and spurious emission according to FCC part

15C, Part 15E, 15.209, 15.207 requirement, only if the test result comply with FCC part 15C, Part 15E, 15.209, 15.207 requirement, then the host can be sold legally.

2.10 Additional testing, Part 15 Subpart B Disclaimer

This transmitter modular us tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B rules requirement applicable to the final host. The final host will still need to be reassessed for compliance to this portion of rules requirements if applicable.

As long as all conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this modular installed.

2.11 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 host integrator must follow the integration instructions provided in this document and ensure that the composite system end product complies with the requirements by a technical assessment or evaluation to the rules and to KDB Publication 996369.

The host integrator installing this module into their product must ensure that the

final composite product complies with the requirements by a technical assessment or evaluation to the rules, including the transmitter operation and should refer to guidance in KDB Publication 996369.

OEM/Host Manufacturer Responsibilities

OEM/Host manufacturers are ultimately responsible for the compliance of the Host and Module. The final product must be reassessed against all the essential requirements of the FCC rule such as FCC Part 15 Subpart B before it can be placed on the US market. This includes reassessing the transmitter module for compliance with the Radio and RF Exposure essential requirements of the FCC rules.

2.12 How to Make Changes - 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.