



FD7155U WIFI Module

Datasheet

V2.1

neardi

Shanghai Neardi Technology Co., Ltd.
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Version History

| Version | Date | Illustrate |
|---------|------------|---|
| V1.0 | 2023/09/19 | Initial Version |
| V2.0 | 2023/12/01 | Update block diagram, electric performance, interface design notice, RF Characteristics, packing specifications |
| V2.1 | 2024/01/05 | Update WiFi Receive Sensitivity Spec |
| | | |
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1 Product Overview

1.1 Product Introduction

FD7155U is a highly integrated, low-cost combo module with high-performance and low-power. It supports Wi-Fi 6 and Bluetooth 5.0 protocol, supports Wi-Fi MAC of the final version of Wi-Fi 6 Wave2 protocol, Wi-Fi Baseband of 1T1R, and high-performance RF. It also supports USB2.0, HS-UART and PCM interfaces for connection with the main control. This module also supports BT and Wi-Fi to work in coexistence mode. It is suitable for consumer electronics such as CPE, IPC, tablet and IOT, and can also be used in fields with high reliability requirements such as industrial interconnection.

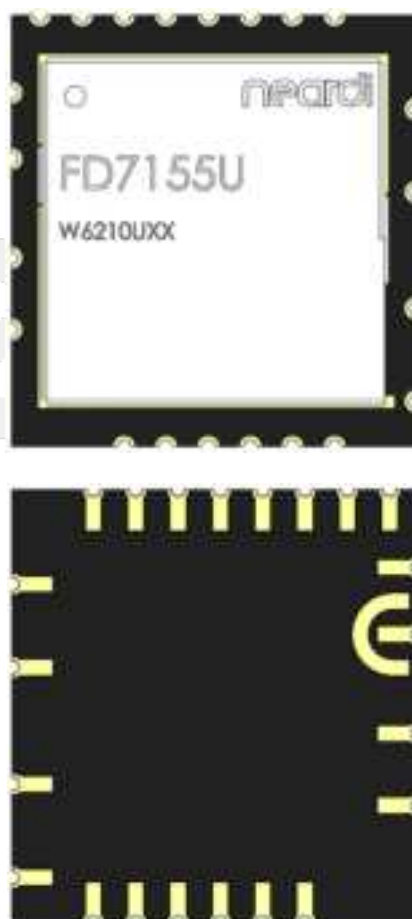


Figure 1-1

1.2 Wi-Fi Characteristics

- ✓ IEEE 802.11a/b/g/n/ac/ax (supports wave-2) wireless LAN communication protocol
- ✓ IEEE 802.11 d/e/h/i/k/mc/r/v/w
- ✓ Phy rate up to 286.8Mbps, Throughput rate up to 260Mbps
- ✓ Multiple modes such as Wi-Fi STA, AP, and P2P
- ✓ 40MHz bandwidth, 1T/1R
- ✓ Up to 1024QAM modulation, supports LDPC and STBC
- ✓ UL/DL OFDMA, DL MU-MIMO
- ✓ QoS, WFA WMM, WMM PS
- ✓ RSSI and CSI Reporting
- ✓ Beamformee and 4*1 Tx Beamforming
- ✓ WPA, WPA2, WPA3 encryption and decryption, WAPI and WPS2.0
- ✓ ER, DCM to improve transceiver gain
- ✓ 20in40/80/160, Partial band MU MIMO to improve air interface utilization;
- ✓ BSS Color, Spatial Reuse to improve air interface utilization
- ✓ TWT, Intra-PPDU PS, VHT TXOP PS to optimize dynamic power consumption in small bandwidth and multi-BSS environment

1.3 Bluetooth Characteristics

- ✓ Support Bluetooth (Classic BT+BLE) v2.1, v3.0, v4.2, v5.0 features
- ✓ USB2.0 interface for BT data transmission
- ✓ PCM/IIS interface for audio transmission
- ✓ BR/EDR/LE 1M/LE 2M/LE LR
- ✓ Support sco and esco link
- ✓ SSP/Secure Connection
- ✓ Low power mode (sniff, sniff sub-rating)
- ✓ Support BT/Wi-Fi coexistence

1.4 Block Diagram

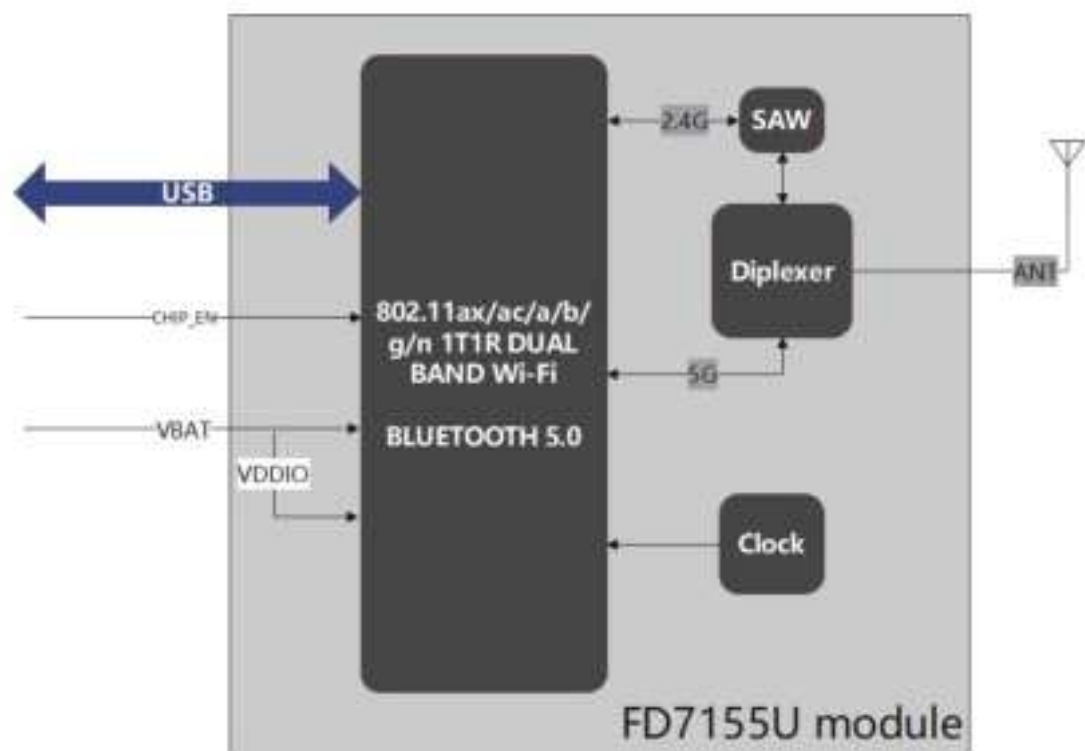


Figure 1-4

1.5 Parameters

Table 1-5

| Product Name | FD7155U |
|-----------------------|--|
| Product description | 802.11ax/ac/a/b/g/n 1T1R dual band Wi-Fi and Bluetooth 5.0 comb module |
| Dimension | 13(±0.1)mm*12.2(±0.1)mm*1.65(±0.2)mm |
| Power supply | VBAT: 3.0~3.6V |
| Host interface | USB2.0 |
| Footprint | LCC 22pin |
| Operating temperature | -30°C to 70°C |
| Operating humidity | 10% to 90% (Non-Condensing) |
| Storage temperature | - 40°C to 85°C |

2 Pin Definition

2.1 Pin Number



Figure 2-1

2.2 Pin Description

Table 2 -2

| Pin Number | Pin Name | Pin Type | Pin Description |
|------------|-----------|----------|--|
| 1 | GND | G | Ground connections |
| 2 | WL_BT_ANT | RF | RF I/O port |
| 3 | NC | - | Floating (Don't connected to ground) |
| 4 | GND | G | Ground connections |
| 5 | NC | - | Floating (Don't connected to ground) |
| 6 | NC | - | Floating (Don't connected to ground) |
| 7 | NC | - | Floating (Don't connected to ground) |
| 8 | NC | - | Floating (Don't connected to ground) |
| 9 | NC | - | Floating (Don't connected to ground) |
| 10 | NC | - | Floating (Don't connected to ground) |
| 11 | VBAT | P | Main power voltage source input |
| 12 | USB_DM | I/O | USB Transmitter/Receiver Differential Pair |
| 13 | USB_DP | I/O | USB Transmitter/Receiver Differential Pair |
| 14 | GND | G | Ground connections |

| | | | |
|----|---------|---|--------------------------------------|
| 15 | NC | - | Floating (Don't connected to ground) |
| 16 | NC | - | Floating (Don't connected to ground) |
| 17 | NC | - | Floating (Don't connected to ground) |
| 18 | CHIP_EN | I | Module enable signal |
| 19 | NC | - | Floating (Don't connected to ground) |
| 20 | NC | - | Floating (Don't connected to ground) |
| 21 | NC | - | Floating (Don't connected to ground) |
| 22 | NC | - | Floating (Don't connected to ground) |

3 Mechanical Specifications

3.1 Mechanical Dimensions

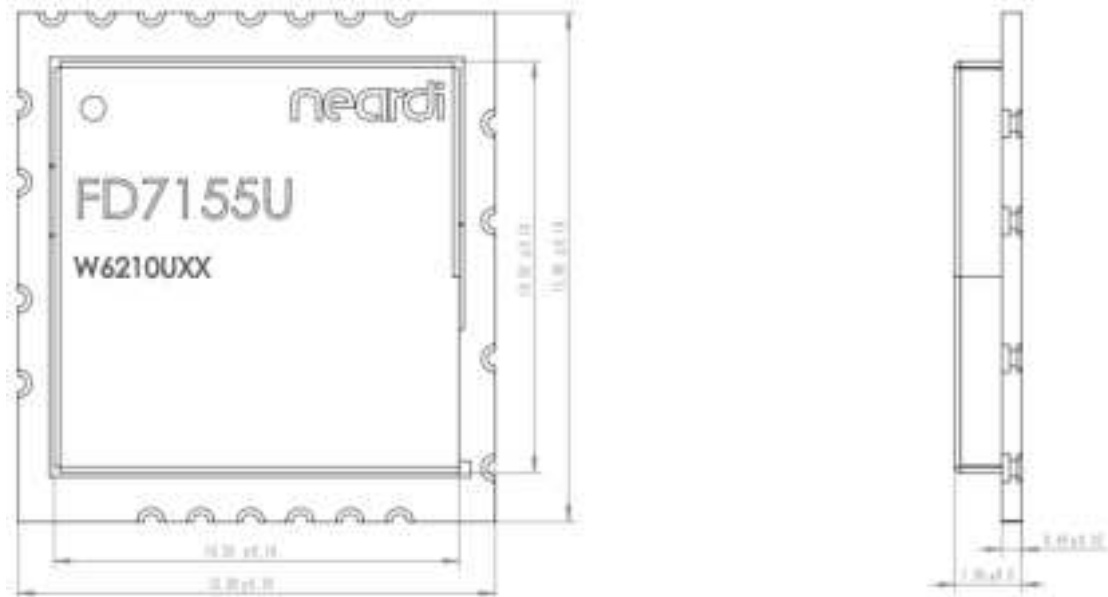


Figure 3-1

3.2 Recommended PCB Layout Footprint

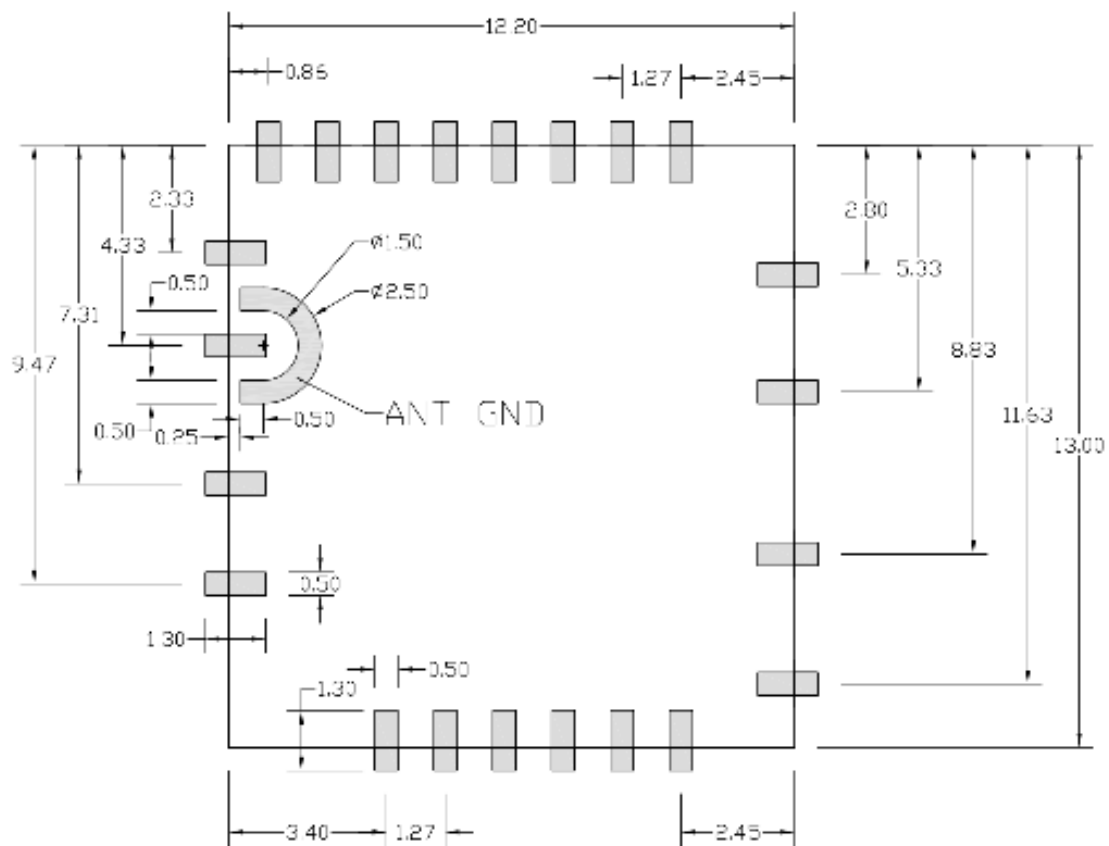


Figure 3-2

4 Electrical Performance and Reliability

4.1 Absolute Maximum Voltage Range

Table 4-1

| Symbol | Description | Min | Max | Unit |
|--------|----------------------|------|-------------------|------|
| VBAT | Power Supply Voltage | -0.5 | 5.25 ¹ | V |

4.2 Recommended Operation Conditions

Table 4-2

| Symbol | Description | Min | Type | Max | Unit |
|---------|-------------------------------|-----|--------|-----|------|
| Ta | Ambient Operating Temperature | -30 | 25 | 70 | °C |
| Antenna | External Antenna VSWR | - | 1.92:1 | 2:1 | |
| VBAT | Power Supply Voltage | 3.0 | 3.3 | 3.6 | V |

4.3 Power On/Off Sequence

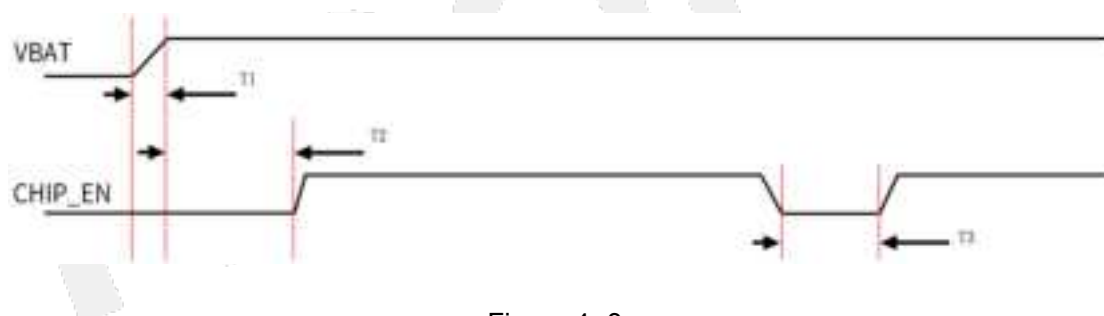


Figure 4 -3

Table 4-3

| Symbol | Description | Min | Type | Max | Unit |
|--------|--|-----|------|-----|------|
| T1 | VBAT Ramp up time | 0.2 | 0.5 | - | mS |
| T2 | CHIP_EN should be powered on after VDDIO is powered on | 0 | - | - | mS |
| T3 | CHIP_EN reset time | 50 | - | - | mS |

¹ If the voltage exceeds this value, the chip will be irreversibly damaged.

4.4 Reliability

Table 4-4

| Item | Test Model | Class | Level | Criteria |
|----------|------------|-------|----------|------------------------------------|
| ESD | HBM | 2 | 2000V | ANSI/ESDA/JEDEC JS-001-2017 |
| | CDM | C2a | 500V | ANSI/ESDA/JEDEC JS-002-2018 |
| Latch-up | Current | II A | 200mA | JEDEC STANDARD NO.78F JANUARY 2022 |
| | Voltage | II A | 1.5xVmax | JEDEC STANDARD NO.78F JANUARY 2022 |

5 RF Characteristics

5.1 2.4GHZ Wi-Fi Radio Frequency (RF) Characteristics

Table 5 -1

| Conditions: VBAT=3.3V; VDDIO=1.8V; Ta:25°C | | | | | |
|--|---|--|-------------|---------|-------------------|
| Features | Description | | | | |
| Wi-Fi Standard | IEEE 802.11b/g/n/ac/ax | | | | |
| Frequency Range | 2.4~2.4835GHz(2.4GHz ISM Band) | | | | |
| Channels | Ch1~Ch13 | | | | |
| Modulation | 802.11b (DSSS): CCK, DQPSK, DBPSK; | | | | |
| | 802.11g (OFDM): BPSK, QPSK, QAM16, QAM64; | | | | |
| | 802.11n (OFDM): BPSK, QPSK, QAM16, QAM64; | | | | |
| | 802.11ac (OFDM): BPSK, QPSK, QAM16, QAM64, QAM256; | | | | |
| | 802.11ax (OFDMA): BPSK, BPSK_DCM, QPSK, QPSK_DCM, QAM16, QAM16_DCM, QAM64, QAM256, QAM1024; | | | | |
| Data Rate | 802.11b: 1, 2, 5.5, 11Mbps; | | | | |
| | 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps; | | | | |
| | 802.11n (HT20): MCS0~MCS7 6.5~72.2Mbps; | | | | |
| | 802.11n (HT40): MCS0~MCS7 13.5~150Mbps; | | | | |
| | 802.11ac(VHT20): MCS0~MCS8 6.5~86.7Mbps; | | | | |
| | 802.11ac(VHT40): MCS0~MCS9 13.5~200Mbps; | | | | |
| | 802.11ax (HE20): MCS0~MCS11 8~143.4Mbps; | | | | |
| 802.11ax (HE40): MCS0~MCS11 16~286.8Mbps; | | | | | |
| Frequency Tolerance | ±5ppm | | | | |
| 2.4G Transmitter Specifications | | | | | |
| Modulation | TX Rate | | TX EVM (dB) | TX Mask | VBAT current (mA) |
| 802.11b | 1Mbps | | ≤35% | PASS | 470 |
| 802.11b | 11Mbps | | ≤35% | PASS | 303 |
| 802.11g | 6Mbps | | ≤-5 | PASS | 318 |
| 802.11g | 54Mbps | | ≤-25 | PASS | 385 |
| 802.11n | HT20 MCS0 | | ≤-5 | PASS | 305 |
| 802.11n | HT20 MCS7 | | ≤-28 | PASS | 303 |
| 802.11n | HT40 MCS0 | | ≤-5 | PASS | 302 |
| 802.11n | HT40 MCS7 | | ≤-28 | PASS | 275 |
| 802.11ac | VHT20 MCS0 | | ≤-5 | PASS | 305 |
| 802.11ac | VHT20 MCS8 | | ≤-30 | PASS | 270 |
| 802.11ac | VHT40 MCS0 | | ≤-5 | PASS | 296 |
| 802.11ac | VHT40 MCS9 | | ≤-32 | PASS | 230 |
| 802.11ax | HE20 MCS0 | | ≤-5 | PASS | 280 |

| 802.11ax | HE20 MCS11 | | ≤-35 | PASS | 254 |
|------------------------------|------------|--------------------------|-----------------------|------|-------------------|
| 802.11ax | HE40 MCS0 | | ≤-5 | PASS | 279 |
| 802.11ax | HE40 MCS11 | | ≤-35 | PASS | 193 |
| 2.4G Receiver Specifications | | | | | |
| Modulation | RX Rate | Min Input Level (dBm) | Max Input Level (dBm) | PER | VBAT current (mA) |
| 802.11b | 1Mbps | ≤-96 | -5 | 8% | 118 |
| 802.11b | 11Mbps | ≤-87 | -5 | 8% | 118 |
| 802.11g | 6Mbps | ≤-92 | -5 | 10% | 118 |
| 802.11g | 54Mbps | ≤-75 | -5 | 10% | 117 |
| 802.11n | HT20 MCS0 | ≤-92 | -5 | 10% | 122 |
| 802.11n | HT20 MCS7 | ≤-72 | -5 | 10% | 120 |
| 802.11n | HT40 MCS0 | ≤-89 | -5 | 10% | 126 |
| 802.11n | HT40 MCS7 | ≤-70 | -5 | 10% | 121 |
| 802.11ac | VHT20 MCS0 | ≤-91 | -5 | 10% | 122 |
| 802.11ac | VHT20 MCS8 | ≤-68 | -5 | 10% | 119 |
| 802.11ac | VHT40 MCS0 | ≤-89 | -5 | 10% | 126 |
| 802.11ac | VHT40 MCS9 | ≤-63 | -5 | 10% | 122 |
| 802.11ax | HE20 MCS0 | ≤-92 | -5 | 10% | 123 |
| 802.11ax | HE20 MCS11 | ≤-60 | -5 | 10% | 119 |
| 802.11ax | HE40 MCS0 | ≤-89 | -5 | 10% | 126 |
| 802.11ax | HE40 MCS11 | ≤-58 | -5 | 10% | 121 |

5.2 5GHZ Wi-Fi RF Characteristics

Table 5 -2

| Conditions: VBAT=3.3V; VDDIO=1.8V; Ta:25°C | |
|--|---|
| Features | Description |
| Wi-Fi Standard | IEEE 802.11a/n/ac/ax |
| 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 |
| Modulation | 802.11a (OFDM): BPSK, QPSK, QAM16, QAM64; 802.11n (OFDM): BPSK, QPSK, QAM16, QAM64; 802.11ac (OFDM): BPSK, QPSK, QAM16, QAM64, QAM256; 802.11ax (OFDMA): BPSK, BPSK_DCM, QPSK, QPSK_DCM, QAM16, QAM16_DCM, QAM64, QAM256, QAM1024; |
| Date Rate | 802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps; 802.11n (HT20): MCS0~MCS7: 6.5~72.2Mbps; 802.11n (HT40): MCS0~MCS7: 13.5~150Mbps; 802.11ac (VHT20): MCS0~MCS8: 6.5~86.7Mbps; 802.11ac (VHT40): MCS0~MCS9: 13.5~200Mbps; 802.11ax (HE20): MCS0~MCS11: 8~143.4Mbps; 802.11ax (HE40): MCS0~MCS11: 16~286.8Mbps; |

| Frequency Tolerance | ≤±5ppm | | | | |
|-------------------------------|------------|-----------------------|-----------------------|---------|-------------------|
| 5G Transmitter Specifications | | | | | |
| Modulation | TX Rate | | TX EVM (dB) | TX Mask | VBAT current (mA) |
| 802.11a | 6Mbps | | ≤-5 | PASS | 315 |
| 802.11a | 54Mbps | | ≤-25 | PASS | 377 |
| 802.11n | HT20 MCS0 | | ≤-5 | PASS | 312 |
| 802.11n | HT20 MCS7 | | ≤-28 | PASS | 313 |
| 802.11n | HT40 MCS0 | | ≤-5 | PASS | 281 |
| 802.11n | HT40 MCS7 | | ≤-28 | PASS | 263 |
| 802.11ac | VHT20 MCS0 | | ≤-5 | PASS | 313 |
| 802.11ac | VHT20 MCS8 | | ≤-30 | PASS | 279 |
| 802.11ac | VHT40 MCS0 | | ≤-5 | PASS | 286 |
| 802.11ac | VHT40 MCS9 | | ≤-32 | PASS | 219 |
| 802.11ax | HE20 MCS0 | | ≤-5 | PASS | 288 |
| 802.11ax | HE20 MCS11 | | ≤-35 | PASS | 254 |
| 802.11ax | HE40 MCS0 | | ≤-5 | PASS | 270 |
| 802.11ax | HE40 MCS11 | | ≤-35 | PASS | 185 |
| 5G Receiver Specifications | | | | | |
| Modulation | RX Rate | Min Input Level (dBm) | Max Input Level (dBm) | PER | VBAT current (mA) |
| 802.11a | 6Mbps | -91 | -5 | 10% | 125 |
| 802.11a | 54Mbps | -74 | -5 | 10% | 123 |
| 802.11n | HT20 MCS0 | -91 | -5 | 10% | 129 |
| 802.11n | HT20 MCS7 | -71 | -5 | 10% | 125 |
| 802.11n | HT40 MCS0 | -88 | -5 | 10% | 132 |
| 802.11n | HT40 MCS7 | -69 | -5 | 10% | 127 |
| 802.11ac | VHT20 MCS0 | -91 | -5 | 10% | 130 |
| 802.11ac | VHT20 MCS8 | -67 | -5 | 10% | 125 |
| 802.11ac | VHT40 MCS0 | -88 | -5 | 10% | 132 |
| 802.11ac | VHT40 MCS9 | -63 | -5 | 10% | 136 |
| 802.11ax | HE20 MCS0 | -91 | -5 | 10% | 130 |
| 802.11ax | HE20 MCS11 | -60 | -5 | 10% | 125 |
| 802.11ax | HE40 MCS0 | -89 | -5 | 10% | 131 |
| 802.11ax | HE40 MCS11 | -58 | -5 | 10% | 127 |

5.3 Bluetooth Radio Frequency (RF) Characteristics

Table 5 -3

| Conditions: VBAT=3.3V; VDDIO=1.8V; Ta:25°C | |
|--|-----------------------------------|
| Features | Description |
| Bluetooth Standard | Bluetooth v2.1+EDR/3.0+HS/4.2/5.0 |
| Frequency Range | 2.4~2.4835GHz |

| Channels | Bluetooth Classic: Ch0~Ch78 (For 1MHz Channels); Bluetooth Low Energy: Ch0~Ch39 (For 2MHz Channels); | | | | |
|-----------------------------------|--|-----|-----------------------|-----|--------------|
| Power class | Bluetooth Classic: Class1; Bluetooth Low Energy: Class1.5; | | | | |
| Modulation | BR_1Mbps: GFSK; EDR_2Mbps: $\pi/4$ -DQPSK; EDR_3Mbps: 8DPSK; LE_125Kbps: GFSK (Coded_S=8); LE_500Kbps: GFSK (Coded_S=2); LE_1Mbps: GFSK (Uncoded); LE_2Mbps: GFSK (Uncoded); | | | | |
| Bluetooth Receiver Specifications | | | | | |
| Item | Sensitivity (dBm) | | Max Input Level (dBm) | | VBAT current |
| | Input Level (Typ) | BER | Input Level (Typ) | BER | (mA) |
| BR_1M | TBD | TBD | TBD | TBD | TBD |
| EDR_2M /3M | TBD | TBD | TBD | TBD | TBD |
| LE_125/500K | TBD | TBD | TBD | TBD | TBD |
| LE_1M | TBD | TBD | TBD | TBD | TBD |
| LE_2M | TBD | TBD | TBD | TBD | TBD |

6 Hardware Design Guide

6.1 Power Design Notice

6.1.1 Voltage Requirement

The main power supply (VBAT) input range of the module is 3.3V \pm 10%, and the interface VDDIO supports two level ranges, 1.8V \pm 10% or 3.3V \pm 10%. Due to the ripple of the main power can affect the RF performance of Wi-Fi and Bluetooth, therefore the power supply ripple VPP is required to be less than 50mV.

6.1.2 Current Requirement

Under different standards, when Wi-Fi transmits continuously, the peak value and amplitude of the operating current on the main power supply are as shown in the table below. The 3.3V power converter must be able to provide 650mA RMS current and fast transient response (when the transient current change rate is 80mA/us, the voltage drop is less than 100mV).

Table 6-1-2

| Mode | | Peak current (mA) | RMS current (mA) |
|--------------------------|--|-------------------|------------------|
| 11b 11M long 2.4G ch1 | | 833 | 607 |
| | | 753 | 573 |
| | | 647 | 473 |
| | | 593 | 440 |
| | | 566 | 407 |
| 11ax MCS0 2.4G CH1 | | 720 | 500 |
| | | 640 | 427 |
| | | 587 | 420 |
| | | 553 | 393 |
| 11ax MCS0 5G CH36 | | 827 | 560 |
| | | 667 | 433 |
| | | 620 | 380 |
| | | 540 | 307 |

7 Storage, Production and Packaging

7.1 Storage Conditions

- ❖ FD7155U module is 3 (MSL3) and packed in a vacuum-sealed bag when shipped, the recommended storage temperature is $25\pm5^{\circ}\text{C}$, and the relative humidity is 35%~60%. Under this condition, the module can be stored for 12 months.
- ❖ The Module shall be stored without opening the packing. After the packing opened, the module shall be completed the patch soldering within 24 hours.
- ❖ FD7155U module can be stored for no more than 168 hours in a workshop environment with a temperature of $25\pm5^{\circ}\text{C}$, a relative humidity below 60% and in compliance with IPC/JEDEC J-STD-033. It is not recommended to expose the module unpacked to the air for a long time. If not immediately patch soldering, it is recommended to store the module in a moisture-proof cabinet with a relative humidity of less than 10% to keep the module dry.
- ❖ If the module is not stored according to the above recommended method, it needs to be baked at high temperature ($120\pm5^{\circ}\text{C}$) for 8 hours. The re-baked module shall be patched within 24 hours.
- ❖ Please pay attention to ESD protection when unpacking and handling modules.

7.2 Production Welding

During the production welding process, please do not use any organic solvents (such as alcohol, isopropanol, acetone, trichloroethylene, etc.) to wipe the shield of the FD7155U module, otherwise it may cause the shield to rust. Please do not ultrasonically clean the module, it may cause damage to the crystal inside the module. Please make sure that the spray material used will not chemically react with the module shield or PCB and will not flow into the module when spraying modules.

In order to ensure the welding quality and reliability of the FD7155U module, the thickness of the printed stencil is recommended to be 0.15~0.18mm; the recommended reflow curve is as follows:

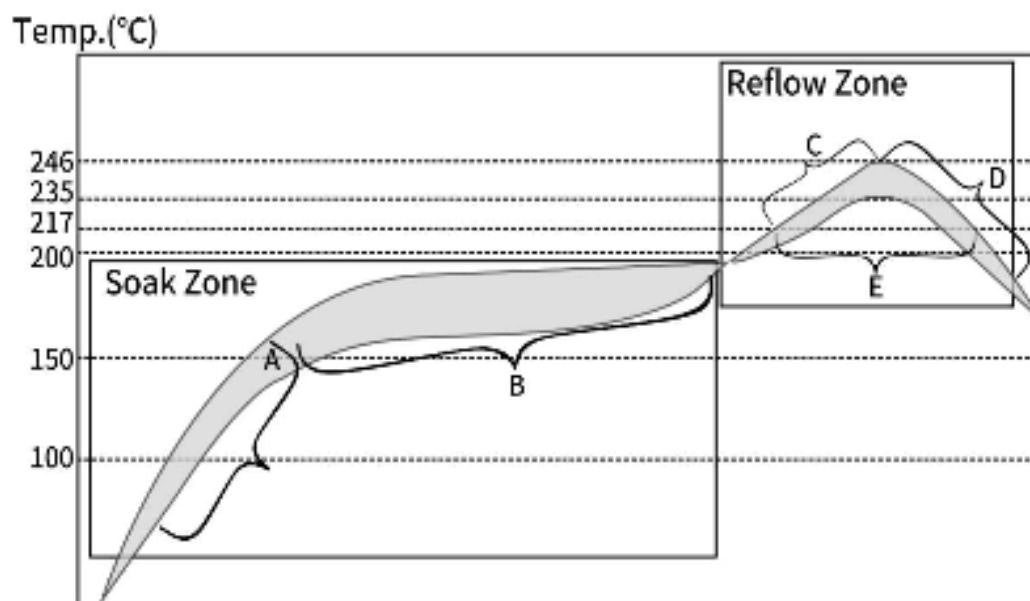


Figure 7 -2 Recommended reflow curve

Table 7 -2

| Item | Description | Value |
|-------------------------------|---|---|
| Endothermic Zone Heating Rate | Interval A | $\leq 3^{\circ}\text{C/s}$ |
| Soak time | From the end of interval A to the beginning of interval B | 60~120s |
| Reflow Zone Heating Rate | Interval C | $\leq 3^{\circ}\text{C/s}$ |
| Maximum Temperature | Highest point of the curve | $246^{\circ}\text{C} (+5/-0^{\circ}\text{C})$ |
| Cooling Rate | Interval D | $< 6^{\circ}\text{C/s}$ |
| Reflow Time | Interval E | 60~150 seconds |

7.3 Packing Specifications

The key parameters and packaging processes described in this chapter are for reference only. The appearance and structure of the specific packaging materials are subject to actual delivery.

7.3.1 Tape Dimensions

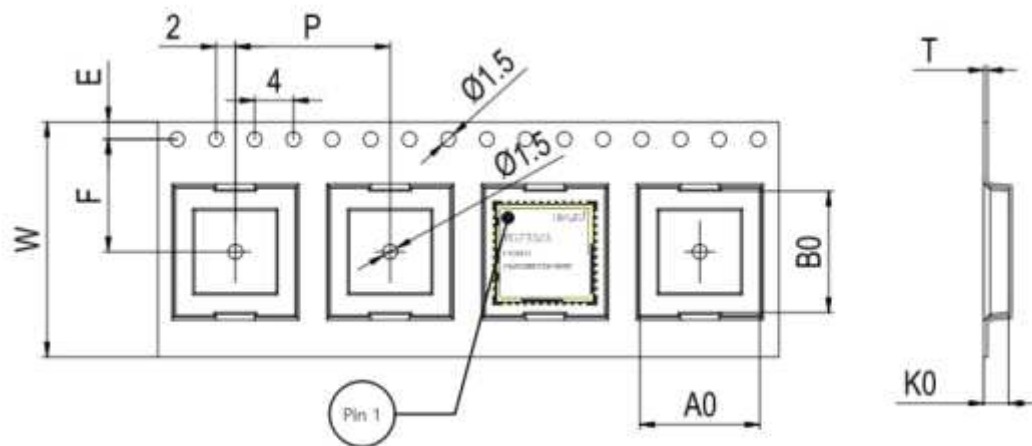


Figure 7-3-1 Tape dimensions

Table 7-3-1

| W | P | T | A0 | B0 | K0 | F | E | Unit |
|----|----|------|------|------|-----|------|------|------|
| 24 | 16 | 0.35 | 12.6 | 13.4 | 2.5 | 11.5 | 1.75 | mm |

7.3.2 Plastic Reel Dimensions

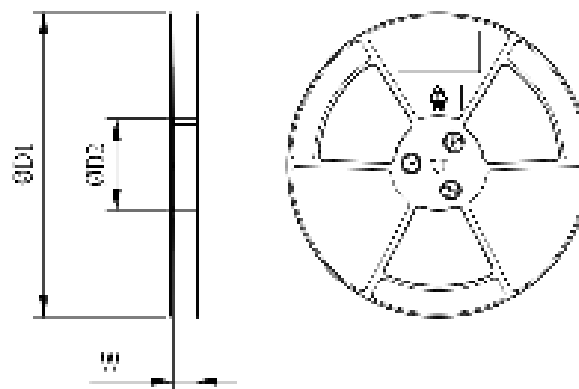


Figure 7-3-2 Tape dimension

Table 7-3-2

| ØD1 | ØD2 | W | unit |
|-----|-----|----|------|
| 330 | 100 | 24 | mm |

7.3.3 Packaging Process

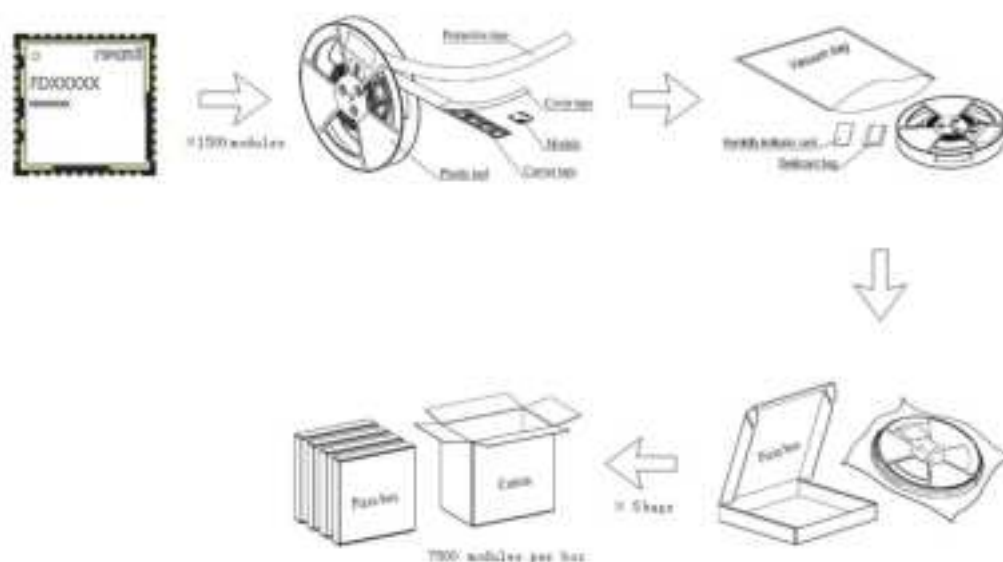


Figure 7-3-3 Package specification

8 Antenna Design

8.1 Summarize

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

8.2 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

8.3 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.

8.4 Limited Module Procedures

Not applicable

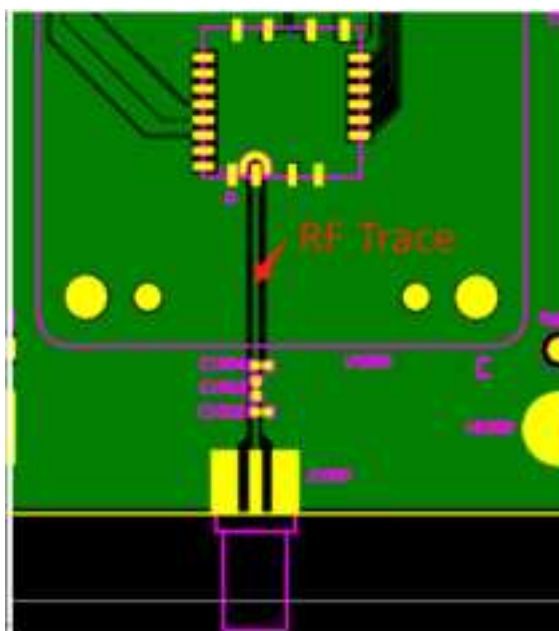
8.5 Trace Antenna Designs

Users should connect antennas to half hole pad through copper tube structure or FP types of RF trace and the trace impedance must be controlled in 50Ω. recommends that the total insertion loss between the antenna pads and antennas should meet

the following requirements:

| Frequency | Loss |
|-----------------|--------|
| 2400MHz-2500MHz | <0.6dB |
| 5150MHz-5850MHz | <1.2dB |

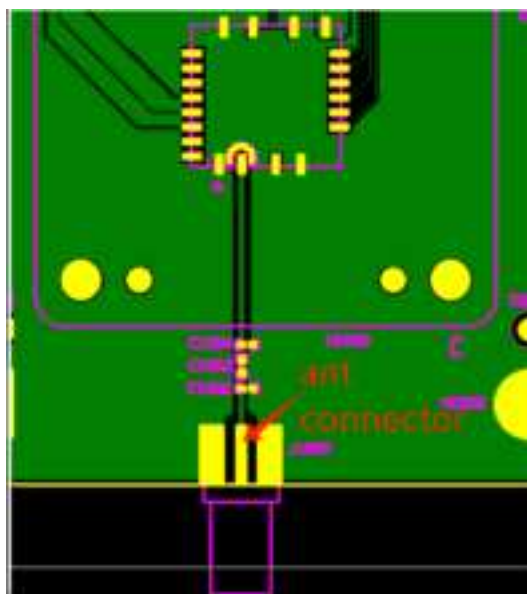
To facilitate the antenna tuning and certification test, a RF connector and an antenna matching circuit should be added. The following figure is the recommended circuit.



The module needs to be attached to the PCB board and connected to the external antenna through the solder joint of the circuit on the PCB. The gain of the external antenna is 2dB (i Max.) ,the internal structure is copper tube structure or FPC. A resistance of 0R is added between the module and the antenna at C1003 to ensure that the impedance of the connection between the module and the antenna reaches 50R. The J0800 position on the PCB is where the external antenna is connected.

RF traces layout

- 1.Keep the RF trace from module ant pin to antenna as short as possible
- 2.RF trace should be 50 Ω either on the top layer or in the inner layer
- 3.RF trace should be avoided right angle and sharp angle.
- 4.Put enough GND vias around RF traces.
- 5.RF trace should be far away from other high speed signal lines.



External Antenna VSWR

| Parameters | Min | Typ | Max |
|-----------------------|-----|-----|-----|
| External Antenna VSWR | | 1.6 | 2.0 |

8.6 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.

8.7 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 MHz | 5150-5250 MHz | 5250-5350 MHz | 5470-5725 MHz | 5725-5850 MHz |
| FD210U | External Antenna | / | 2.00dBi | 2.00dBi | 2.00dBi | 2.00dBi | 2.00dBi |

8.8 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: **2AL6KBL-M8800DS1**". The FCC ID can be used only when all FCC compliance requirements are met.

8.9 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.

8.10 Additional testing, Part 15 Subpart B Disclaimer

This transmitter modular is 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.

8.11 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.

8.12 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.