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UZ2400
Data Sheet

2.4 GHz IEEE Std. 802.15.4™
RF Transceiver Module

Note the label artwork for Products

FCC ID: 2AAUWHRF24B21AN
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.

2.4 GHz IEEE Std. 802.15.4™ RF Transceiver Module

Features:

- IEEE 802.15.4-2006 Compliant RF Transceiver
- Small Size: 25mm*12.5mm Surface Mountable
- Integrated Crystal, Internal Voltage Regulator, Matching Circuitry and PCB Antenna.
- Radio Regulation Certification for United States (FCC ID)
- Up to 300m Range (outdoor, line-of-sight)

Operational:

- Operating Voltage: 2.0V-3.6V(3.3V typical)
- Temperature Range: -20°C to +60°C
- Simple, Four-Wire SPI Interface

RF/Analog

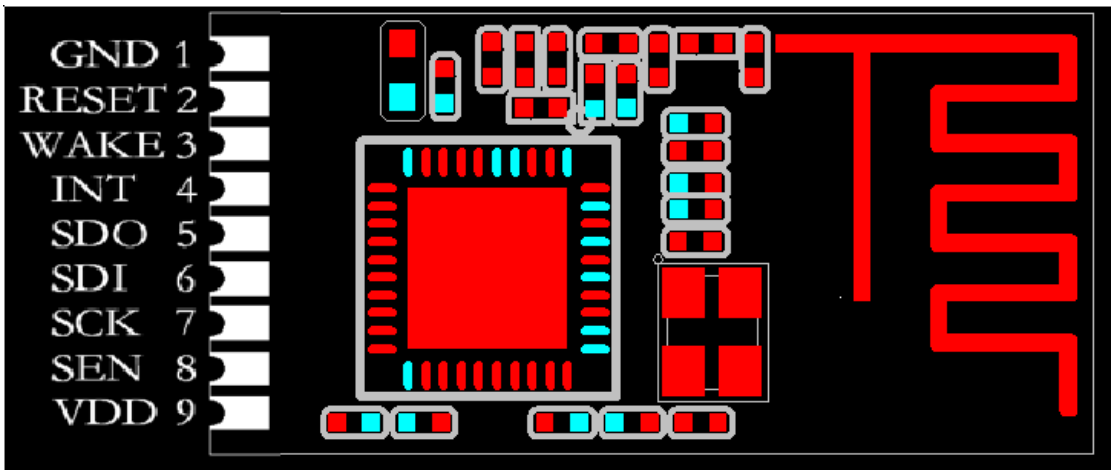
- ISM band 2.405~2.480 GHz operation
- Integrated low phase noise VCO, frequency synthesizer and PLL loop filter
- Integrated 32 MHz oscillator drive
- Integrated internal oscillator circuit
- Single End RF input/output
- 32 MHz reference clock output

- Digital VCO and filter calibration
- High receiver and RSSI dynamic range
- 1M/2M bps turbo mode supported

Mac/Baseband

- IEEE 802.15.4-2006 specification compliance
- Hardware CSMA-CA mechanism, automatic ACK response and FCS check
- Programmable ‘Superframe’ construction
- Functionally independent TX FIFOs, including beacon FIFO, transmit FIFO and GTS FIFOs
- Dual RX FIFOs
- Hardware security engine
- Various power saving modes
- Support all CCA modes and RSSI/LQI

FIGURE 1: PIN DIAGRAM



Device Overview

HRF24B21AN is a solution that complies with IEEE 802.15.4-2006 specifications. It integrates a 2.4 GHz RF transceiver with an IEEE802.15.4 compliant Baseband/MAC block within a single chip. The HRF24B21AN can be controlled by a microprocessor (e.g. 8051) for low-data-rate applications such as home automation, industrial automation, consumer electronics, PC peripheral …etc. For medium-data-rate applications like wireless voice and image transmission, the HRF24B21AN provides 1M/2M bps turbo mode.

FIGURE 2: BLOCK DIAGRAM

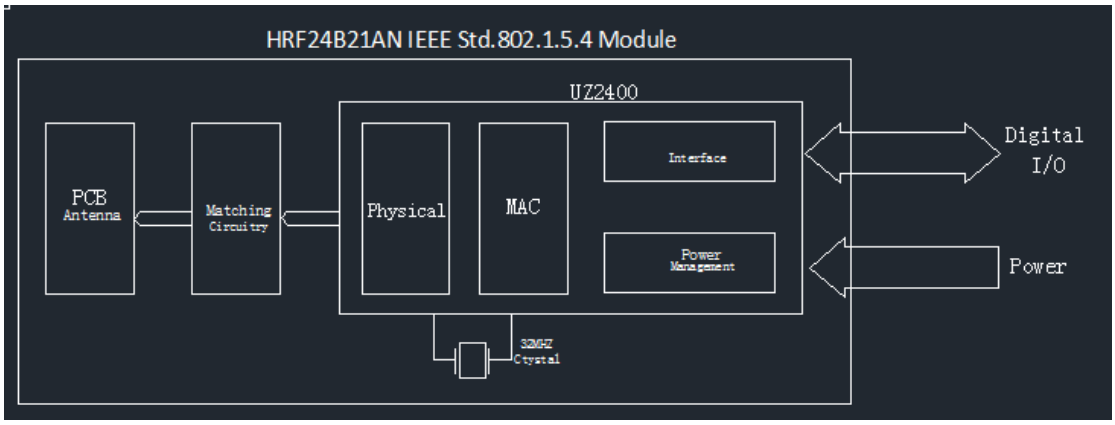
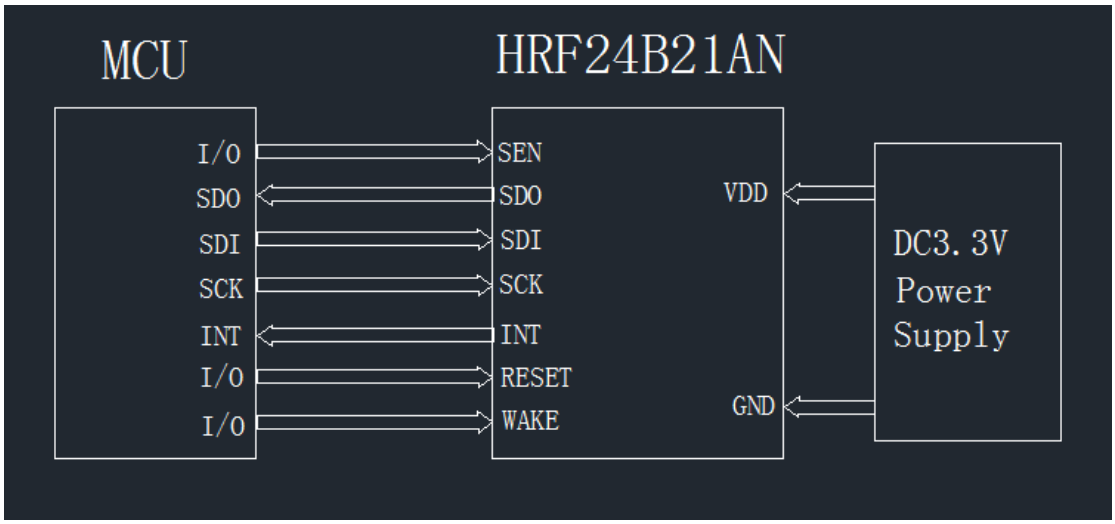


TABLE 1-1: PIN DESCRIPTION

Pin	Symbol	Type	Description
1	GND	Ground	Ground
2	RESET	DI	Global hardware reset pin, active low
3	WAKE	DI	External wake up trigger
4	INT	DO	Interrupt pin to microprocessor
5	SDO	DO	Serial interface data output from the US2400
6	SDI	DI	Serial interface data input to the US2400
7	SCK	DI	Serial interface clock
8	SEN	DI	Serial interface enable
9	VDD	Power	Power supply

Legend: Pin type abbreviation: D=Digital, I=Input, O=Output

FIGURE 3: MICROCONTROLLER TO HRF24B21AN INTERFACE



Mounting Details

The HRF24B21AN is a surface mountable module. Module dimensions are shown in Figure 4. The module Printed Circuit Board (PCB) is 0.032" thick with castellated mounting holes on the edge. Figure 5 is a recommended host PCB footprint for the HRF24B21AN. The HRF24B21AN has an integrated PCB antenna. For the best performance, follow the mounting details shown in Figure 6. It is recommended that the module be mounted on the edge of the host PCB and an area around the antenna, approximately 1.2", be kept clear of metal objects. A host PCB ground plane around the HRF24B21AN acts as a counterpoise to the PCB antenna. It is recommended to extend the ground plane at least 0.4" around the module.

FIGURE 4: MODULE DETAILS

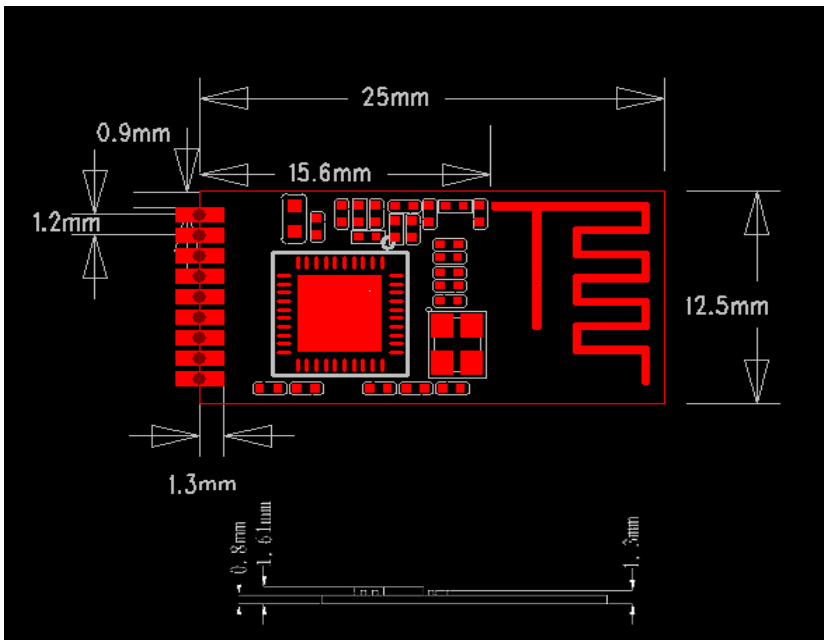


FIGURE 5 RECOMMENDED PCB FOOTPRINT

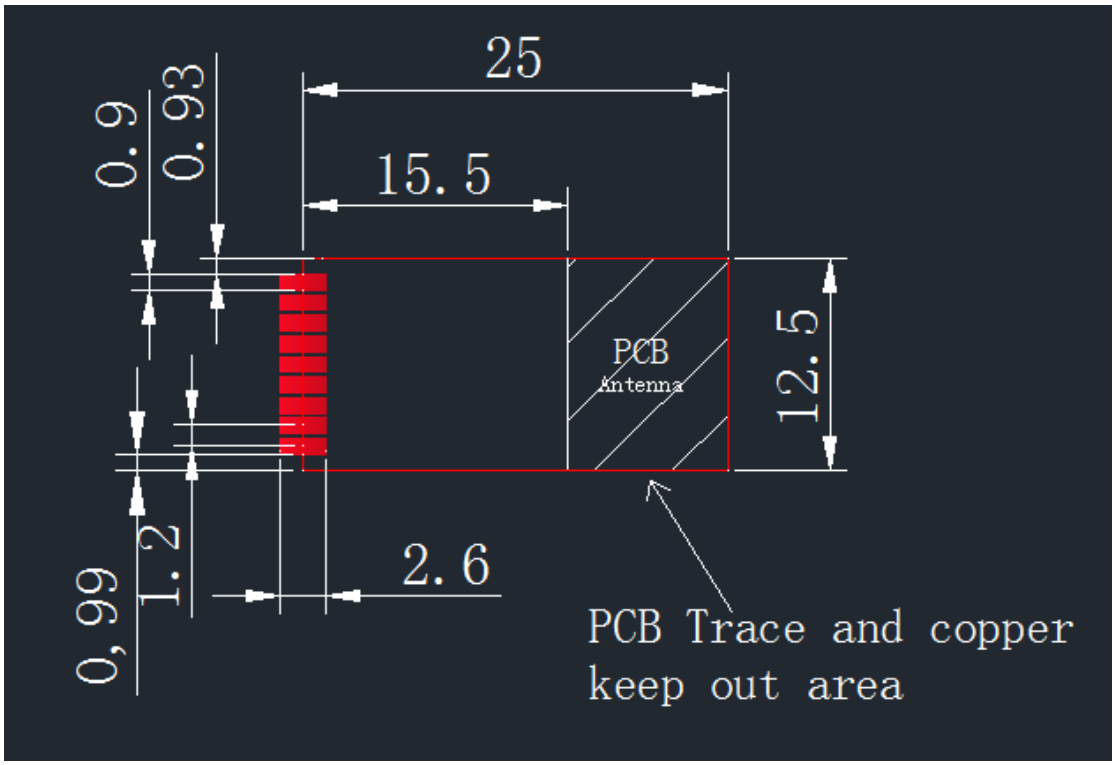
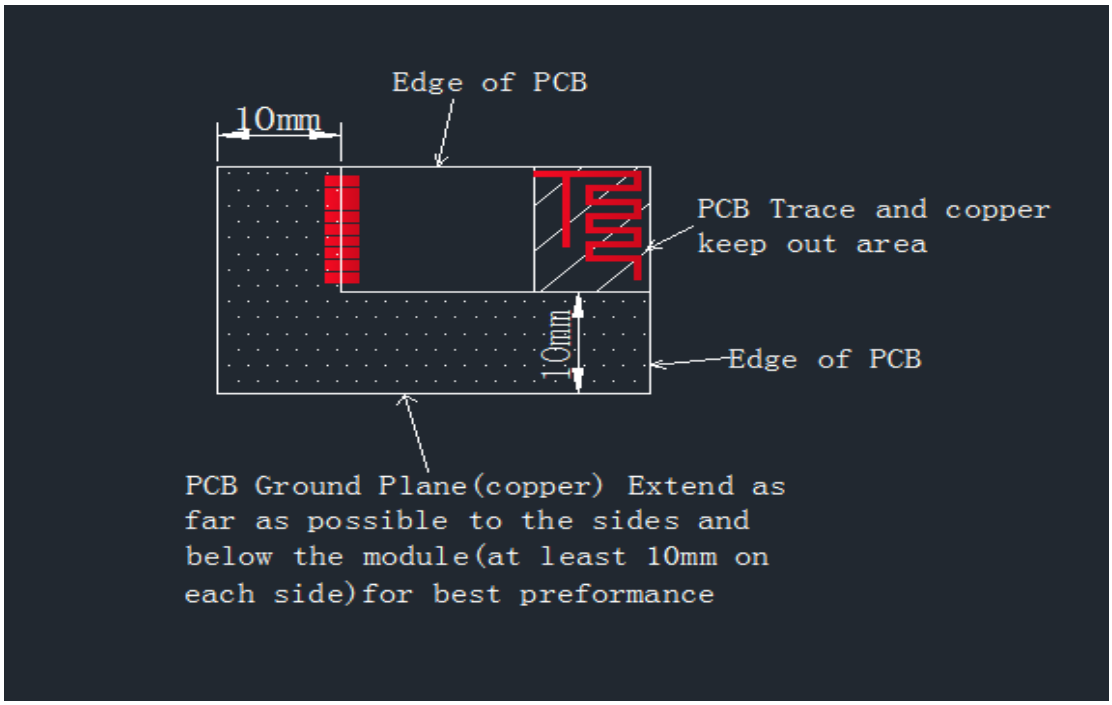


FIGURE 6 MOUNTING DETAILS



CIRCUIT DESCRIPTION

The HRF24B21AN is a complete 2.4 GHz IEEE 802.15.4-2006 compliant surface mount module with integrated crystal, internal voltage regulator, matching circuitry and PCB antenna. The HRF24B21AN module interfaces to many popular micro-controllers via a 4-wire serial SPI interface, interrupt, wake, Reset, power and ground.

SCHEMATIC

A schematic diagram of the module is shown in Figure 7 and the Bill of Materials (BOM) is shown in Table 2. The HRF24B21AN module is based on the Ubec Technology UZ2400 IEEE 802.15.4-2006 GHz RF Transceiver IC. The serial I/O (SCK, SDI, SDO and CS), RESET, WAKE, INT and CLKOUT pins are brought out to the module pins. The SDO signal is tri-state buffered by IC2 to solve a silicon errata where the SDO signal does not release to a high-impedance state after the CS pin returns to its inactive state. Crystal Y1 is a 32 MHz crystal with a frequency tolerance of ±20 ppm @ 25°C to meet the IEEE 802.15.4-2006 symbol rate tolerance of ±40 ppm. A balun is formed by components: C21,C2 and R1. C5 is a DC block capacitor.

FIGURE 7 HRF24B21AN SCHEMATIC

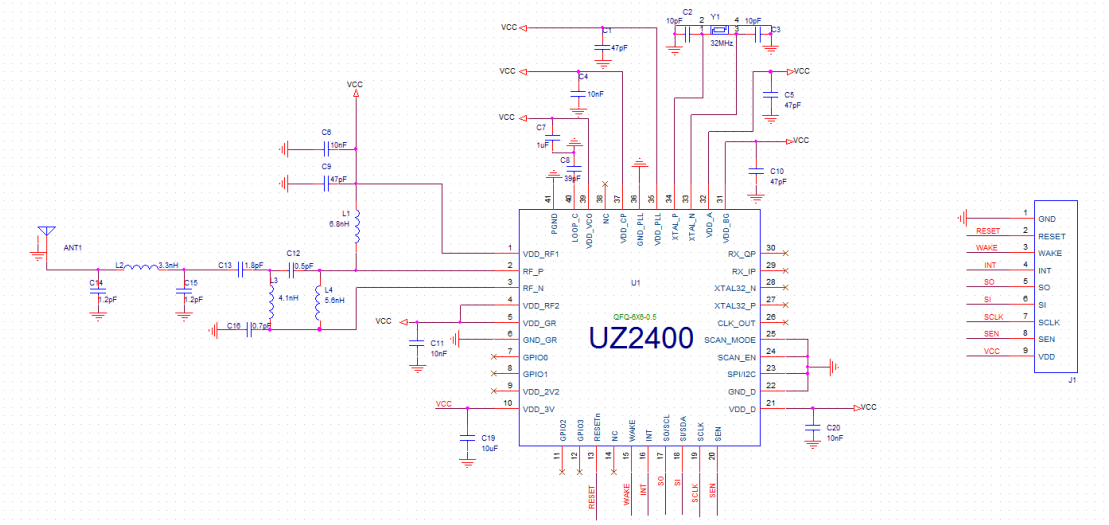


TABLE 2 HRF24B21AN BILL OF MATERIALS

Designator	Description	Manufacturer	Part Number
C1,C5,C9,C10	Cap,0402,47p,50V	SAMSUNG	CL05C470JB5NNNC
C2,C3	Cap,0402,10p,50V	SAMSUNG	CL05C10RCB5NNNC
C4,C6,C11,C20	Cap,0402,0.01uF,50V	SAMSUNG	CL05B103KB5NNNC
C7	Cap,0402,0.1uF,50V	SAMSUNG	CL05B104KB5NNNC
C8	Cap,0402,39p,50V	SAMSUNG	CL05C39RCB5NNNC
C12	Cap,0402,0.5p,50V	SAMSUNG	CL05C0R5CB5NNNC
C13	CAP,1.8P, NP0, ±0.1pF,0402	SAMSUNG	CL05C1R8CB5NNNC
C14,C15	CAP,1.2P, NP0, ±0.1pF,0402	SAMSUNG	CL05C1R2CB5NNNC
C16	CAP,0.7P, NP0, ±0.01pF,0402	SAMSUNG	CL05C0R7CB5NNNC
C19	Cap,0603,10uF,16V	SAMSUNG	CL10B106KO8NNNC
L1	Inductor, 6.8nH,160mA, ±0.1nH,0402	Sunlord	SDCL1005C6N8STDF
L2	Inductor, 3.3nH,160mA, ±0.1nH,0402	Sunlord	SDCL1005C3N3STDF
L3	Inductor, 4.1nH,160mA, ±0.1nH,0402	Sunlord	SDCL1005C4N1STDF
L4	Inductor, 5.6nH,160mA, ±0.1nH,0402	Sunlord	SDCL1005C5N6STDF
U1	IC,UZ2400	UBEC	UZ2400 QFN-40, 6x6mm
Y1	Crystal SMD 3225, 32MHz, 8pF, ±15ppm	Jing Feng	SMD 3225, 32MHz

Printed Circuit Board

The HRF24B21AN module printed circuit board is con-structed with FR4 material, two layers and 0.8mm thick. The layers are shown in Figure 8 through Figure 9. The stack up of the PCB is shown in Figure10

FIGURE 8 TOP COPPER

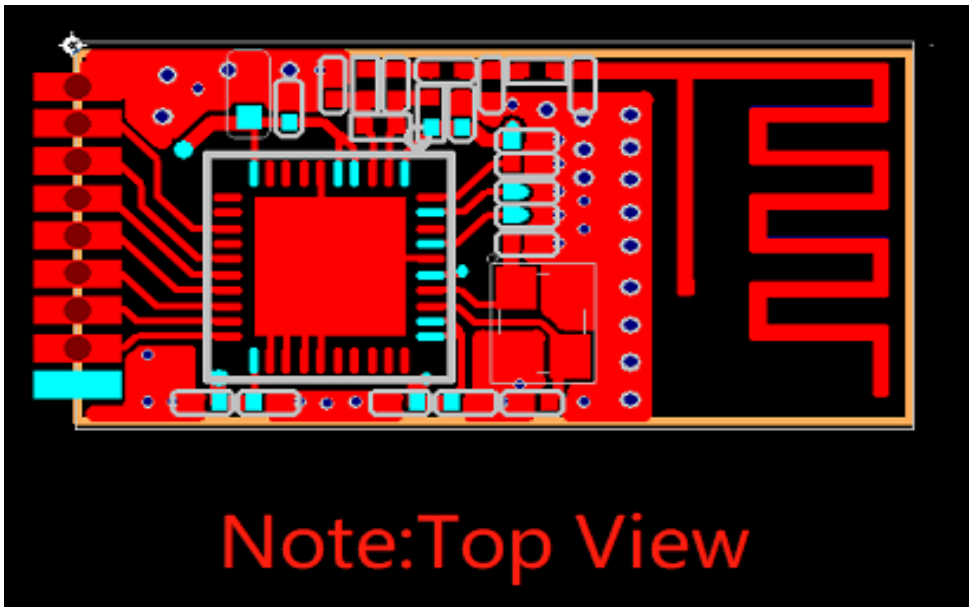


FIGURE 9 BOTTOM COPPER

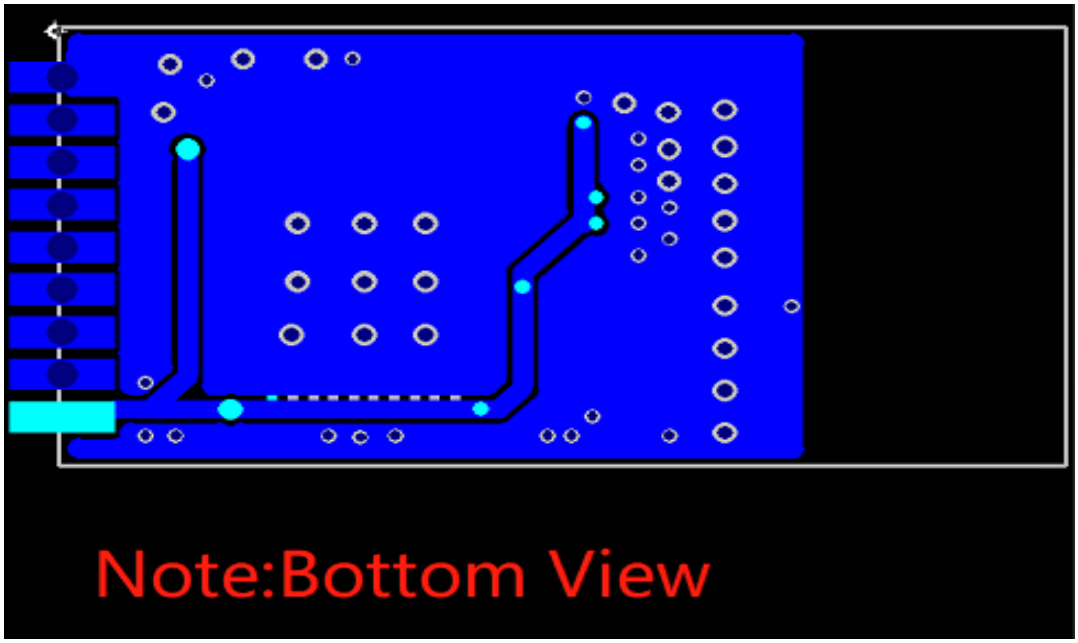
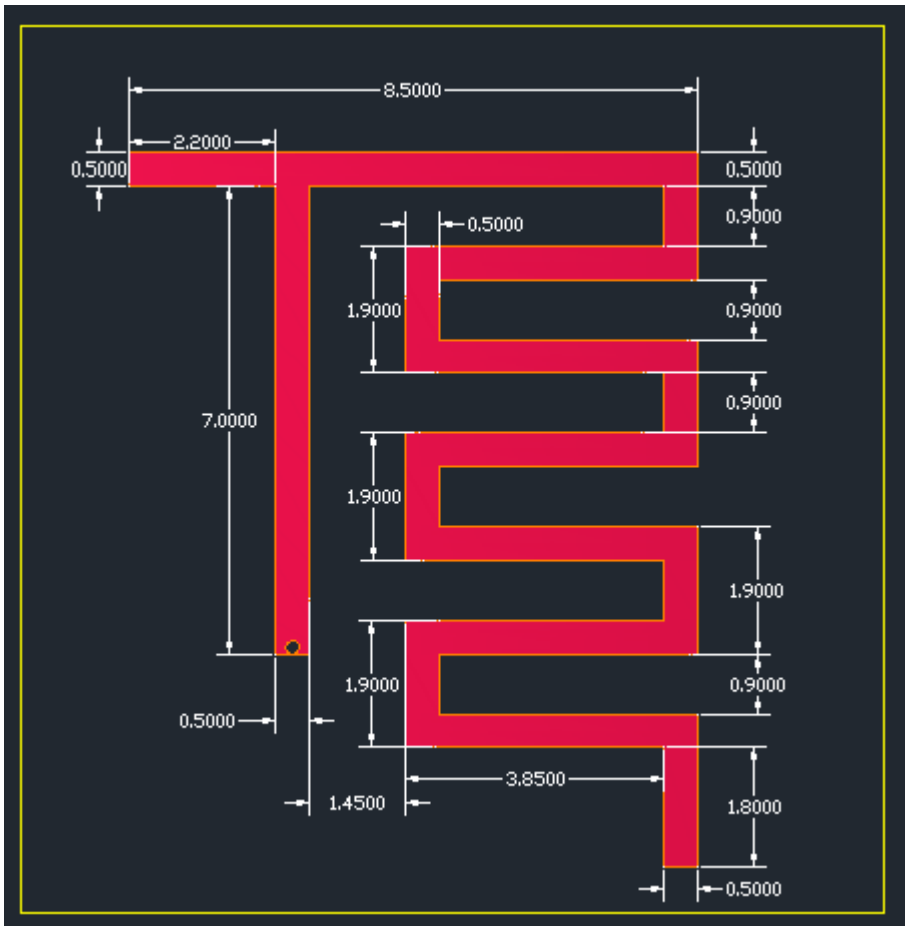


FIGURE 10 PCB LAYER STACK UP

PCB Antenna

The PCB antenna is fabricated on the top copper trace. Figure 11 shows the trace dimensions. The layers below the antenna have no copper traces. The ground and power planes under the components serve as a counterpoise to the PCB antenna. Additional ground plane on the host PCB will substantially enhance the performance of the module.

FIGURE 11 PCB LAYER STACK UP



FCC compliance information 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.
2. This device must accept any interference received, including interference that may cause undesired operation.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

Regulation Information

1) List of applicable FCC rules:

FCC part 15.249

2) Summarize the specific operational use conditions

This Device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter. The host product manufacturer should state this information to the host instruction manual.

3)Limited module procedures:

This module is only use for battery-powered product. The modular transmitter is only approved for use by the grantee in its own products and not intended for sale to third parties.

4)Trace antenna designs

No applicable.

5) RF exposure considerations

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment without any restriction.

6) Antennas

Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Antenna type: Embedded PCB Antenna

Antenna Gain: 0dBi

7)Label and compliance information

A host product shall use a physical label stating “Contains FCC ID: 2AAUWHRF24B21AN” and bear the following statement in a conspicuous location on the device.
"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."

8)Information on test modes and additional testing requirements

When the module is installed in a host, the transmitter can be transmitted by pressing the button.

In product application, a mode of transmitter and receiver matching serial number will be added.

a. With wireless Transmitter and Receiver turned on, press and hold the Receiver’s “Test” or “ Mode” button until the light turns green (about 5 seconds).

b. Activate any Transmitter. The Receiver’s light will flash red 1 time when a link has been established.

c. Press and release the Receiver’s “Test” or “Mode” button to exit linking mode.

9)Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for the specific rule parts (FCC Part 15.249) list on the grant, 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. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed when contains digital circuity.