



HRF24A13AN
Data Sheet

2.4 GHz IEEE Std. 802.15.4™
RF Transceiver Module

Note the label artwork for Products

FCC ID : 2AAUWHRF24A13AN

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.

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: 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.

HRF24A13AN

Note: This 2.4G RF Module is designed to be used internally only in Controls products which with RF shielding. It is not intended to be sold as an end item by itself to external customers.

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

This module and its antenna(s) must not be co-located with any other transmitters except in accordance with FCC multi-transmitter product procedures.

The module is intended only for OEM integrator. And it should not be marketed and sold in a way that has to be end-user accessible / replaceable. The host product is required to comply with all applicable FCC equipment authorizations regulations, requirements and equipment functions not associated with the transmitter module portion. The host manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational.

Label of the end product:

The final end product must be labeled in a visible area with the following "Contains Transmitter Module FCC ID: 2AAUWHRF24A13AN" or "Contains FCC ID: 2AAUWHRF24A13AN". If the size of the end product is larger than 8*10cm, then the following FCC Part 15.19 statement has to also be available on the label: 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.

User manual of the end product:

In the user manual of the end product, the end user has to be informed that:

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: 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.

If the size of the end product is smaller than 8*10cm, then additional FCC Part 15.19 statement is required to be available in the user manual: 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*11.8mm 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: 2.4V-3.6V(3.3V typical)
- Temperature Range: -20°C to +70°C
- Simple, Four-Wire SPI Interface

RF/Analog

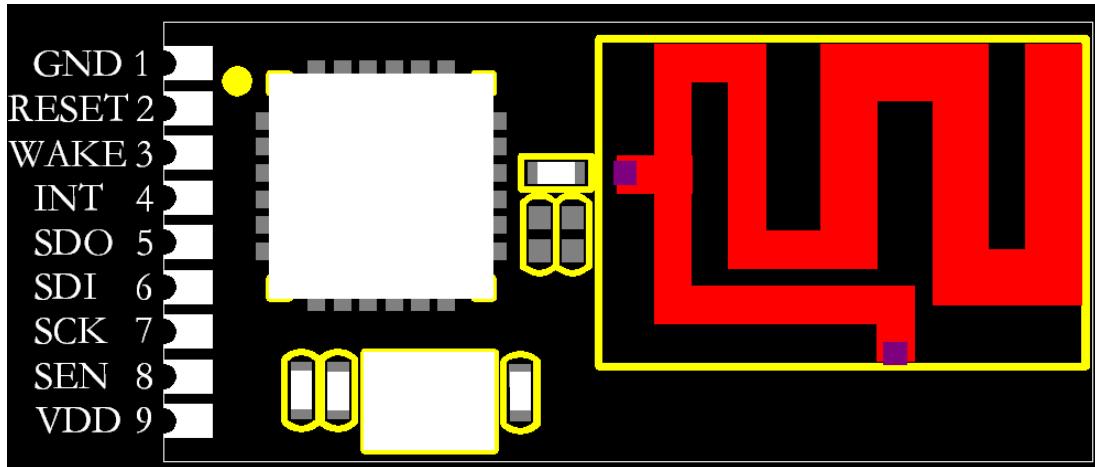
- ISM band 2.405~2.475 GHz operation
- Integrated low phase noise VCO, frequency synthesizer and PLL loop filter
- Integrated 32 MHz oscillator drive
- Integrated internal oscillator circuit
- Single End RF input/output
- 32 MHz reference clock output

- 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

HRF24A13AN 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 HRF24A13AN 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 HRF24A13AN provides 1M/2M bps turbo mode.

FIGURE 2: BLOCK DIAGRAM

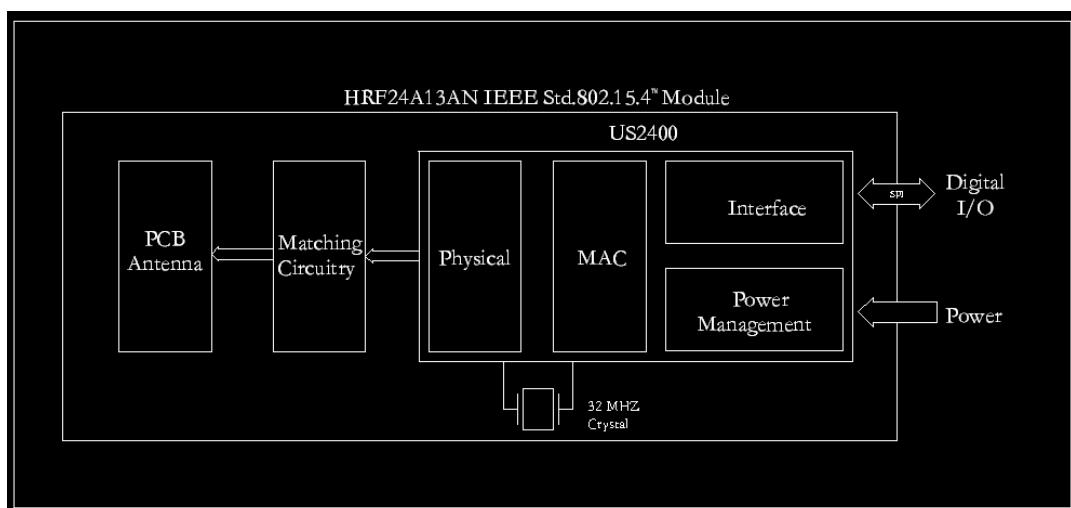
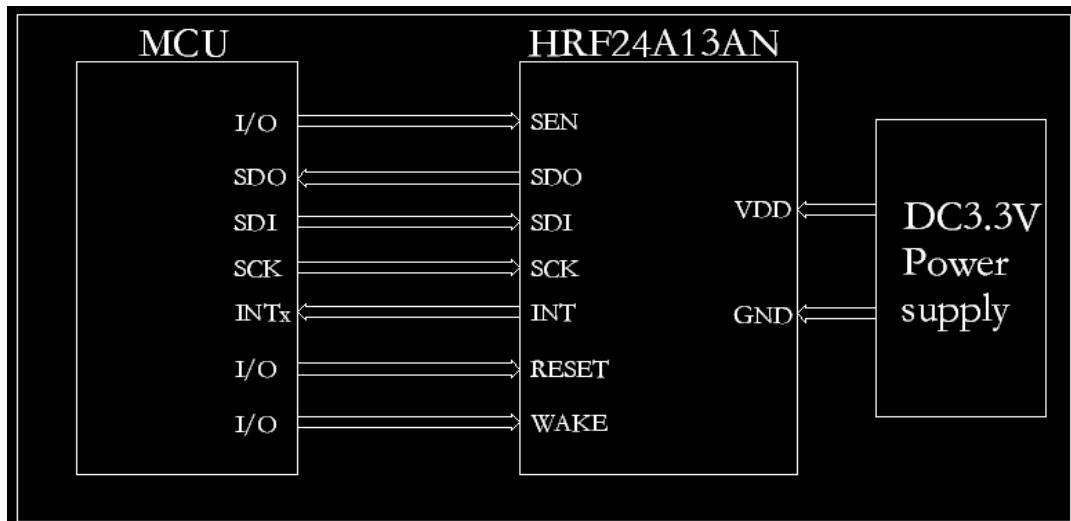


TABLE 1-1: PIN DESCRIPTION

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 HRF24A13AN INTERFACE



Mounting Details

The HRF24A13AN 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 HRF24A13AN. The HRF24A13AN 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 HRF24A13AN 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

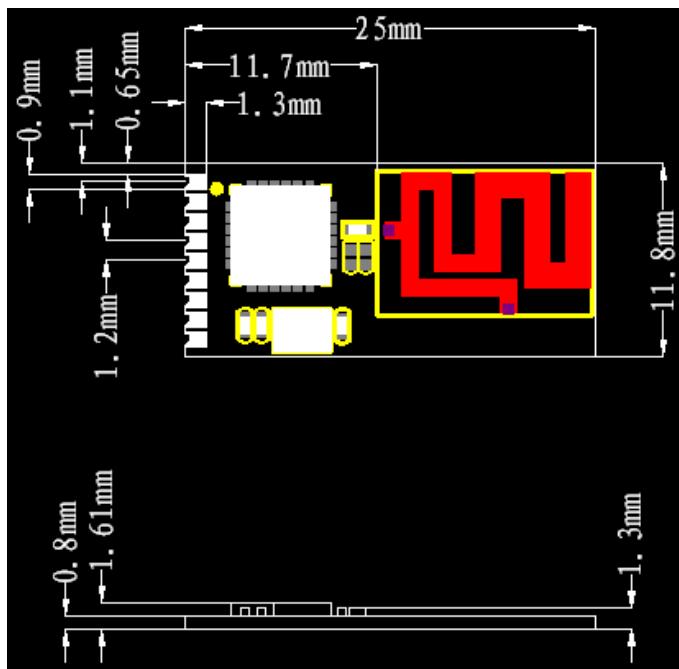


FIGURE 5 RECOMMENDED PCB FOOTPRINT

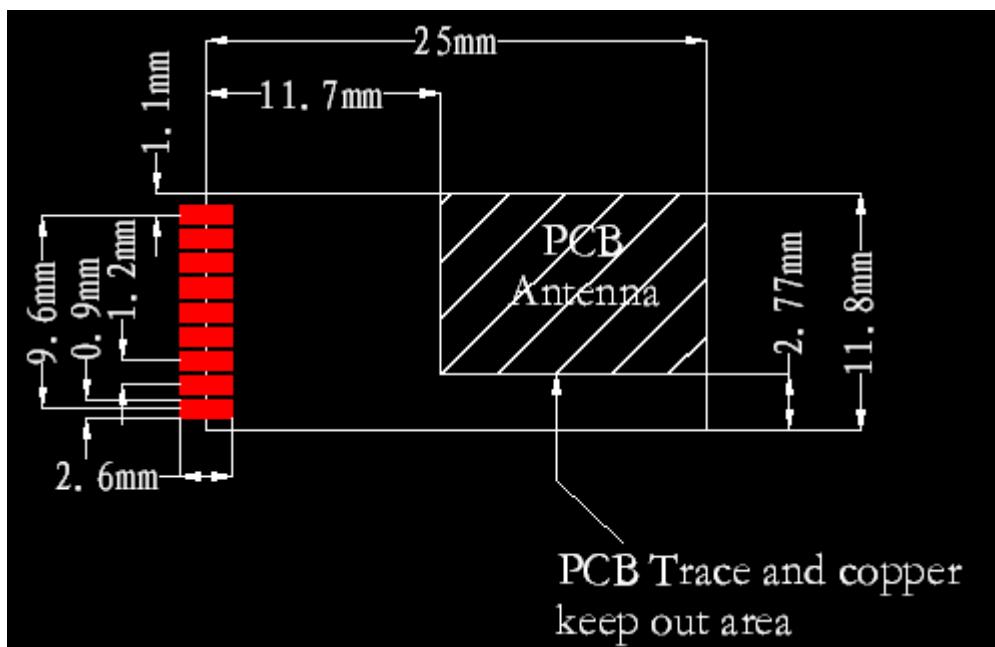
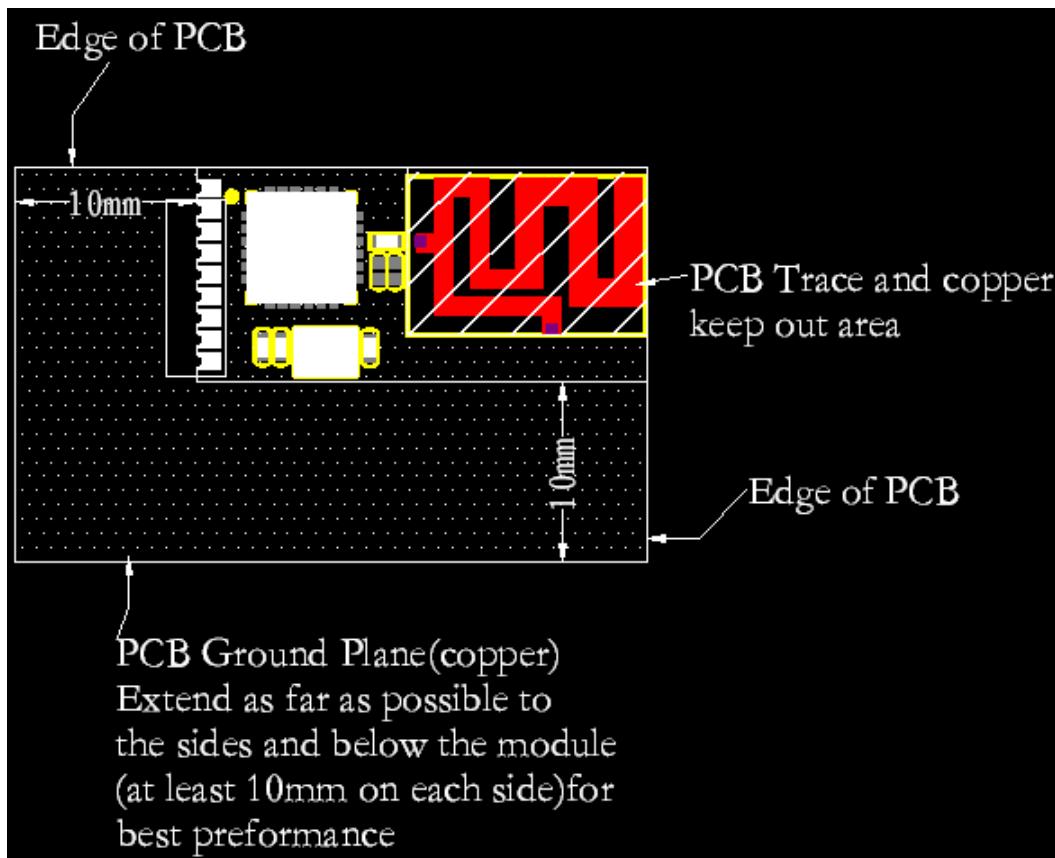


FIGURE 6 MOUNTING DETAILS



CIRCUIT DESCRIPTION

HRF24A13AN

The HRF24A13AN 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 HRF24A13AN 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 HRF24A13AN module is based on the Ubec Technology US2400 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 HRF24A13AN SCHEMATIC

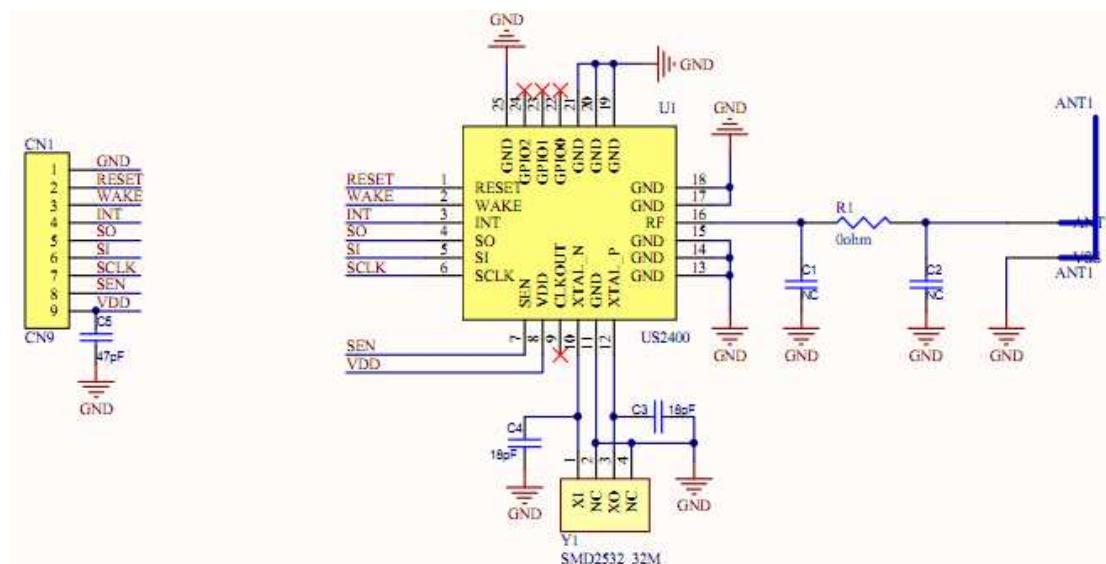


TABLE 2 HRF24A13AN BILL OF MATERIALS

HRF24A13AN

Designator	Description	Manufacturer	Part Number
C1	Not Used		
C2	Not Used		
C3	Chip Capacitor 0402 COG 18P	SAMSUNG	CL05C18RCB5NNNC
C4	Chip Capacitor 0402 COG 18P	SAMSUNG	CL05C18RCB5NNNC
C5	Chip Capacitor 0402 COG 47P	SAMSUNG	CL05C47RCB5NNNC
R1	Resistor Zero OHM 1/16W 5% 0402 SMD	Yageo	RC0402JR-070RL
U1	IC REG 2.4G RF LGA24 Low Power	UBEC	US2400
Y1	Crystal 32MHZ SMT 20PF	Taijing	DSX321G-32M

Printed Circuit Board

The HRF24A13AN module printed circuit board is constructed 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

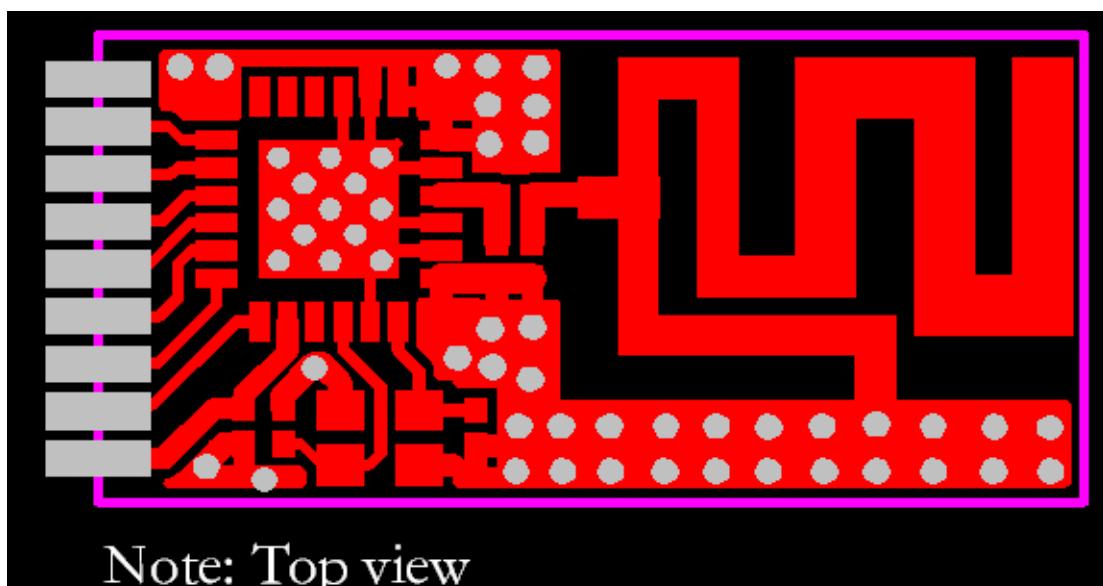
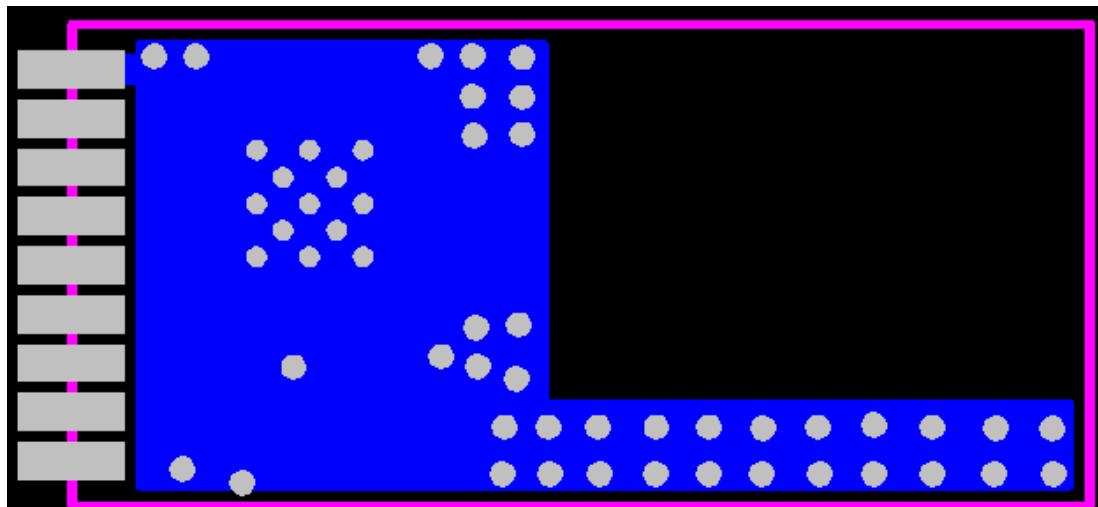
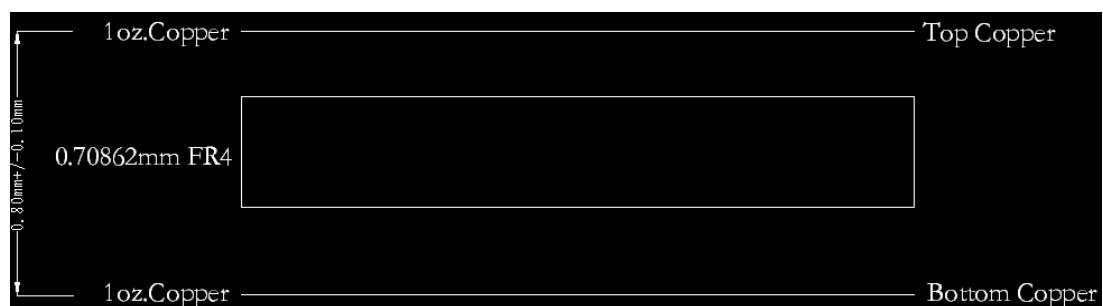


FIGURE 9 BOTTOM COPPER



Note: Top view

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

HRF24A13AN

