AWAIR Sub-1Ghz + NFC Module Datasheet & User Manual

Introduction

The AWAIRNET(AWAIR Mesh Module) is an RF module for the sub-1 GHz ISM bands, such as 780 MHz (China), 868 MHz (Europe) and 915 MHz (North America), optimized for low-power applications. This module combines the Texas Instruments CC1352P1 Sub-1Ghz MCU from the Simplex family. It also includes an NFC controller, PN7150 from NXP. The module has 48 MHz crystal oscillator for the CC1352P1 MCU and a 27.12MHz crystal for the PN7150 Controller. It also houses a 16Mb flash connected to the CC1352P1. All the RF balun network for the Sub-1GHz as well as the NFC RF frontend are houses inside the module and required RF shielding in a compact 25 mm x 57 mm design. The module also houses a uFL connector to connect an external Sub-1GHz antenna to the module. It also houses an onboard antenna connector for the NFC front end that can be used to connect to external NFC antennas. The module has all the necessary GPIOs as well as communication and RF interfaces that is needed to integrate it with an external carrier board. This data sheet provides only a brief overview of the necessary sections of the module. For a detailed description of each peripheral, refer to the datasheets for CC1352P1 and PN7150 MCUs provided by the manufactures.

Features

- **Sub-1GHz MCU**
  - CC1352P SimpleLink™ High-Performance Multi-Band Wireless MCU With Integrated Power Amplifier
  - For detailed information about the MCU. For more details visit the link CC1352P1

- **External Flash**
  - NOR Flash spiFlash, 3V, 16M-bit, 4Kb Uniform Sector. For more details, visit the link W25Q16JVUXIQ

- **NFC Controller**
  - PN7150 High performance NFC controller with integrated firmware, supporting all NFC Forum modes. For more details visit the link PN7150

- **Sub-1GHz Antenna Connector**
  - Onboard uFL connector with onboard matching network to connect to external antennas
  - Antenna connection can be re-routed to castellated PCB pads for antenna connection to trace antennas onboard the carrier PCB

- **NFC Antenna Connector**
  - NFC antenna connector with onboard matching network that can be used to connect to external NFC antenna depending on the application
  - Antenna connection can be re-routed to castellated PCB pads for antenna connection to trace antennas onboard the carrier PCB

- **Peripherals**
  - 20 GPIOs
  - JTAG Interface

- **Clock**
  - Onboard 48MHz crystal connected to the CC1352P1, Sub-1GHz MCU
  - Onboard 27.12MHz crystal connected to the PN1750, NFC controller

- **I/O and Package**
  - 16 programmable I/O pins
  - 25-pin module package (12.7 mm x 11.0 mm) with castellated PCB pads

- **Operating Voltage**
  - 3.3V
  - 5V(optional use for increased NFC antenna range)

- **Temperature Range**
    - -20°C to 55°C
- **Power Consumption**
    - RX_ON = TBD
    - BUSY_TX = TBD
    - Standby = TBD
    - Backup mode = TBD
- Operation Frequency
    - SUB 1G : 902.6 ~ 927.4 MHz
    - NFC : 13.56 MHz

Brief Operational & Technical Description

The module house a very powerful Sub-1GHz MCU form Texas Instrument. The part number is CC1352P1 and it supports all Sub-1GHz bands such as NA(915MHz), EU(868MHz) etc. The module also houses an NFC controller from NXP. The part number is PN7150. The PN7150 is a versatile NFC controller that has integrated firmware and supports all NFC modes of operations. The NFC controller can be configured using the I2C interface that is connected to the CC1352P1. The CC1352P1 can configure the PN7150 and define its modes of operations. The NFC controller, PN7150 has an enable pin that can be controller by a GPIO on the CC1352P1.

The Sub-1GHz MCU can be programmed using the provide JTAG interface on the castellated edge PCB pads. The castellated PCB pads also provides connection to many GPIOs on the CC1352P1 that can be configured for any purposes according to the applications need.
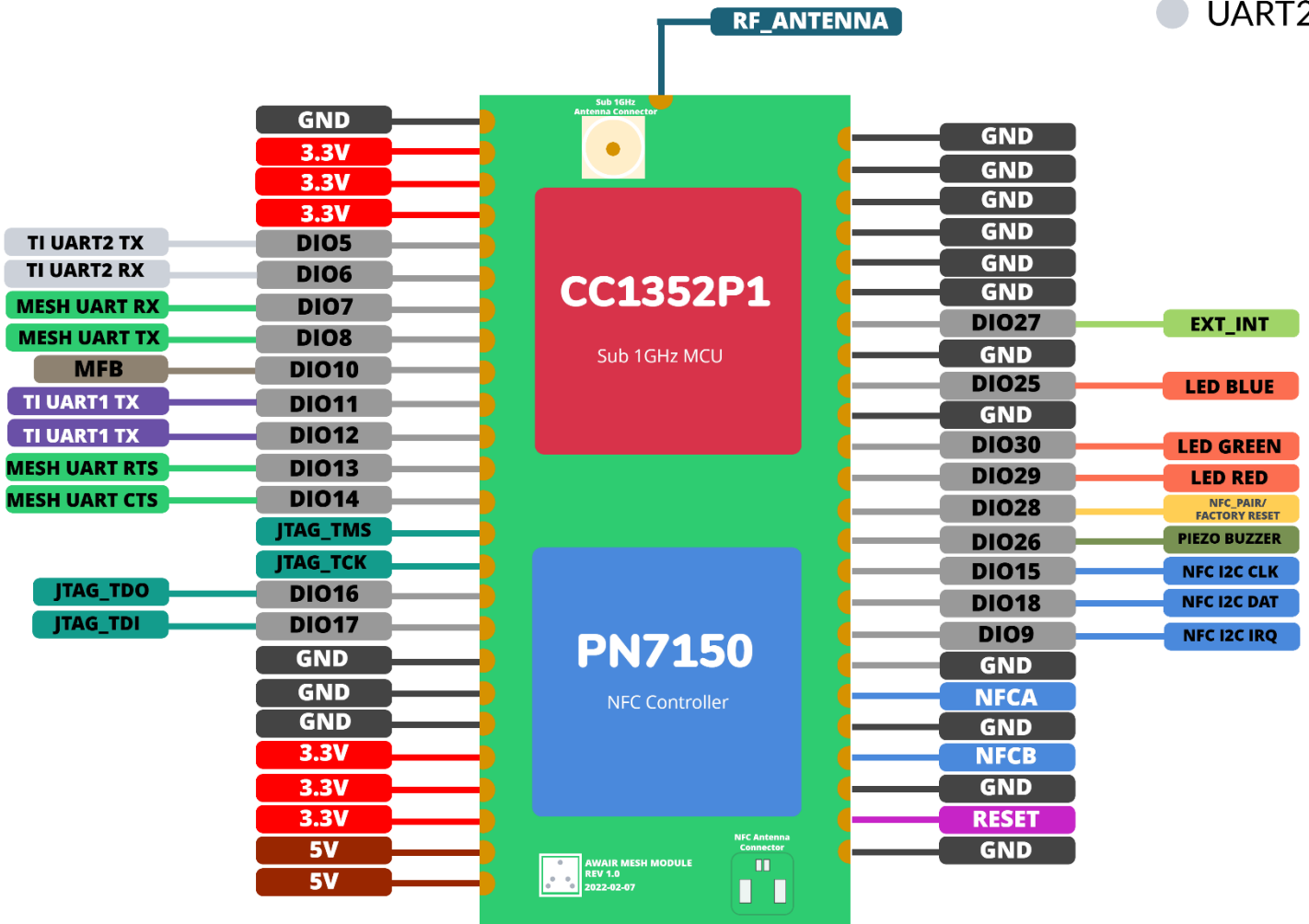
All the RF matching networks as well as the BalUn networks for the Sub-1GHz radio frontend are housed on the module itself. An external antenna can be connected to the modules onboard uFL connector for Sub-1GHz applications. The antenna connection is also available on the castellated PCB pads that can be used to connect to PCB trace antenna onboard the module carrier board.

All the RF matching networks for the NFC frontend are house on the module. An external NFC antenna can be connected to the module using the onboard NFC antenna connector. The NFC antenna connection traces are also available on the castellated PCB pads for easy integration on the module carrier PCB.

All the RF circuitries are enclosed inside an RF graded shield can to reduce EMI.

Peripherals & Pinouts Information

Legend:
- ● GND
- ● 3.3V
- ● 5V
- ● Reset
- ● NFC
- ● LED
- ● JTAG
- ● Mesh UART
- ● UART1
- ● UART2

RF_ANTENNA

Left side pinouts:
- GND
- 3.3V
- 3.3V
- 3.3V
- TI UART2 TX — DIO5
- TI UART2 RX — DIO6
- MESH UART RX — DIO7
- MESH UART TX — DIO8
- MFB — DIO10
- TI UART1 TX — DIO11
- TI UART1 TX — DIO12
- MESH UART RTS — DIO13
- MESH UART CTS — DIO14
- JTAG_TMS
- JTAG_TCK
- JTAG_TDO — DIO16
- JTAG_TDI — DIO17
- GND
- GND
- GND
- 3.3V
- 3.3V
- 3.3V
- 5V
- 5V

Center:
- CC1352P1
- Sub 1GHz MCU
- Sub 1GHz Antenna Connector
- PN7150
- NFC Controller
- AWAIR MESH MODULE REV 1.0 2022-02-07
- NFC Antenna Connector

Right side pinouts:
- GND
- GND
- GND
- GND
- GND
- GND
- DIO27 — EXT_INT
- GND
- DIO25 — LED BLUE
- GND
- DIO30 — LED GREEN
- DIO29 — LED RED
- DIO28 — NFC_PAIR/ FACTORY RESET
- DIO26 — PIEZO BUZZER
- DIO15 — NFC I2C CLK
- DIO18 — NFC I2C DAT
- DIO9 — NFC I2C IRQ
- GND
- NFCA
- GND
- NFCB
- GND
- RESET
- GND

PIN NUMBER	PIN NAME	PIN DESCERIPTION
1	GND	GROUND
2	3.3V	POWER
3	3.3V	POWER
4	3.3V	POWER
5	DIO5	GPIO TO CC1352P1
6	DIO6	GPIO TO CC1352P1
7	DIO7	GPIO TO CC1352P1
8	DIO8	GPIO TO CC1352P1
9	DIO10	GPIO TO CC1352P1
10	DIO11	GPIO TO CC1352P1
11	DIO12	GPIO TO CC1352P1
12	DIO13	GPIO TO CC1352P1
13	DIO14	GPIO TO CC1352P1
14	JTAG_TMS	JTAG INTERFACE TO CC1352P1
15	JTAG_TCK	JTAG INTERFACE TO CC1352P1
16	JTAG_TDO	JTAG INTERFACE TO CC1352P1
17	JTAG_TDI	JTAG INTERFACE TO CC1352P1
18	GND	GROUND
19	GND	GROUND
20	GND	GROUND
21	3.3V	POWER
22	3.3V	POWER
23	3.3V	POWER
24	5V	POWER
25	5V	POWER
26	GND	GROUND
27	RESET	NRESET(ACTIVE LOW)
28	GND	GROUND
29	NFCB	NFC ANTENNA TRACE B
30	GND	GROUND
31	NFCA	NFC ANTENNA TRACE A
32	GND	GROUND
33	DIO9	GPIO TO CC1352P1
34	DIO18	GPIO TO CC1352P1
35	DIO15	GPIO TO CC1352P1
36	DIO26	GPIO TO CC1352P1
37	DIO28	GPIO TO CC1352P1

38	DIO29	GPIO TO CC1352P1
39	DIO30	GPIO TO CC1352P1
40	GND	GROUND
41	DIO25	GPIO TO CC1352P1
42	GND	GROUND
43	DIO27	GPIO TO CC1352P1
44	GND	GROUND
45	GND	GROUND
46	GND	GROUND
47	GND	GROUND
48	GND	GROUND
49	GND	GROUND
50	RF	Sub-1GHz Antenna Pad

Mechanical Descriptions

- **Mechanical Description**
  - This section provides module outline drawings, footprint, application reference design and layout recommendation.
- **Module Outline Drawings**
  - The Mesh module package details are outlined in the following figure.
  - The module pins are arranged with a 2 mm pitch distance. The module is designed in a rectangular way.

Figure A. Module Dimensions
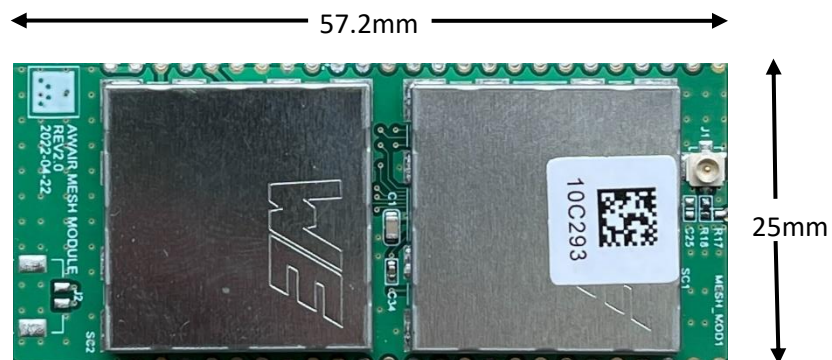
- **Footprint**
    - o The recommended land pattern is shown in the following figure.

Figure B Recommended Base Board Footprint
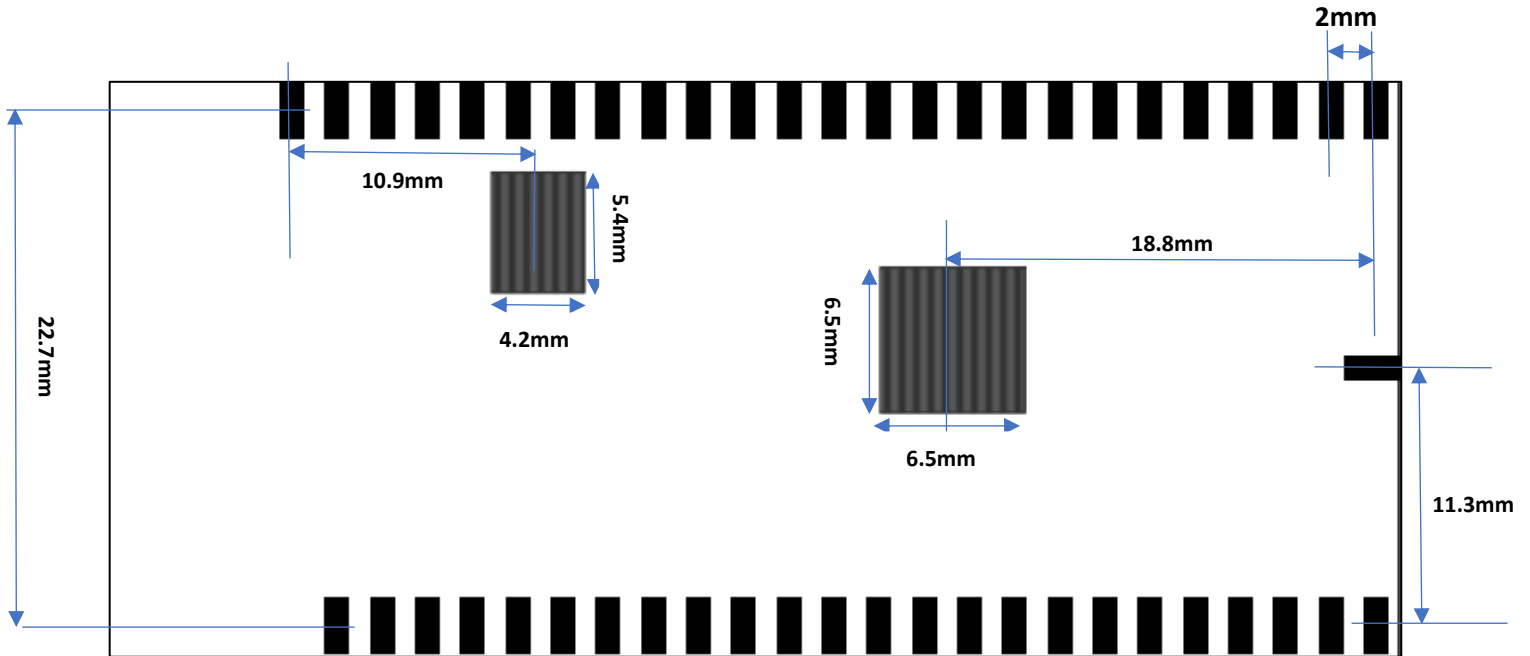
## Design Considerations

- **Approved NFC Antennas**
    - o Part# 1462360121
    - o Rectangular Near Field Communication (NFC) Antenna, with Ferrite, 34.39mm by 46.10mm by 0.27mm
    - o More details about the antenna can be found from the link 1462360121
- **Approved Sub-1GHz Antenna**
    - o Peak Gain: 3.5dBi
    - o Antenna Type: Dipole
    - o Operating Frequency: 863MHz~928MHz

- **Module Placement Design Instructions**
  - Place the module in the corners of the carrier PCB away from high-speed clock and noise sources
  - Green box is the carrier PCB and the blue box is the Module
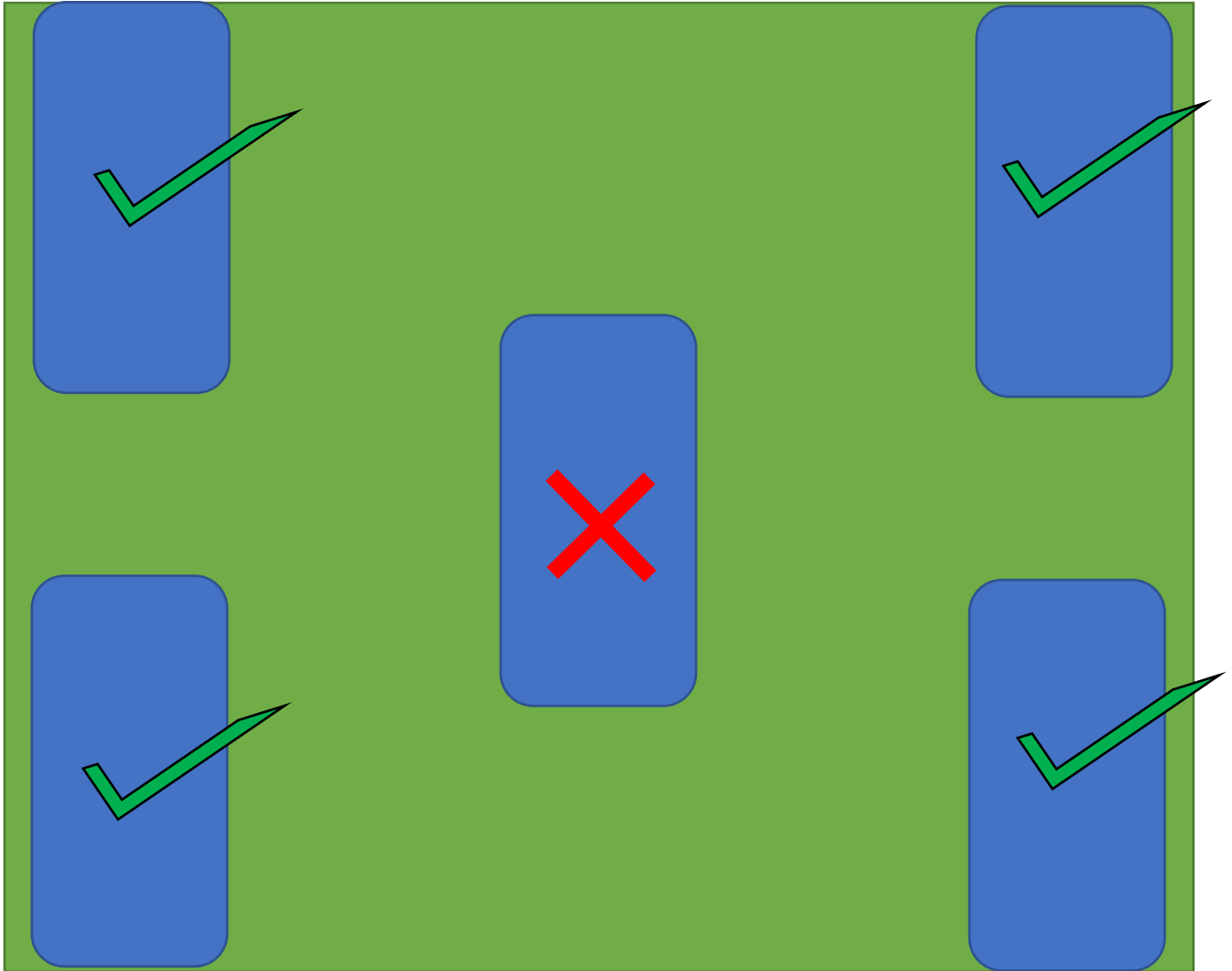
a) Trace layout and dimensions including specific designs for each type:

1. Layout of trace design, parts, antenna, connectors, and isolation requirements;
2. Boundary limits of size, thickness, length, width, shape(s), dielectric constant, and impedance must be clearly described for each type of antenna;
3. Different antenna length and shapes affect radiated emissions, and each design shall be considered a different type; e.g., antenna length in multiple(s) of frequency wavelength and antenna shape (traces in phase) can affect antenna gain and must be considered;
4. The above data is to be provided by a Gerber file (or equivalent) for PC layout.

The module hosts all the RF related circuitry that includes the Blaun network, the antenna matching network leading to the Antenna connector. In case of the NFC controller, the Antenna connection pins are routed to the PCB castellated pads and that in turn is routed to the carrier PCB that houses the NFC antenna connector as shown in the image below. The related gerber file is also provided
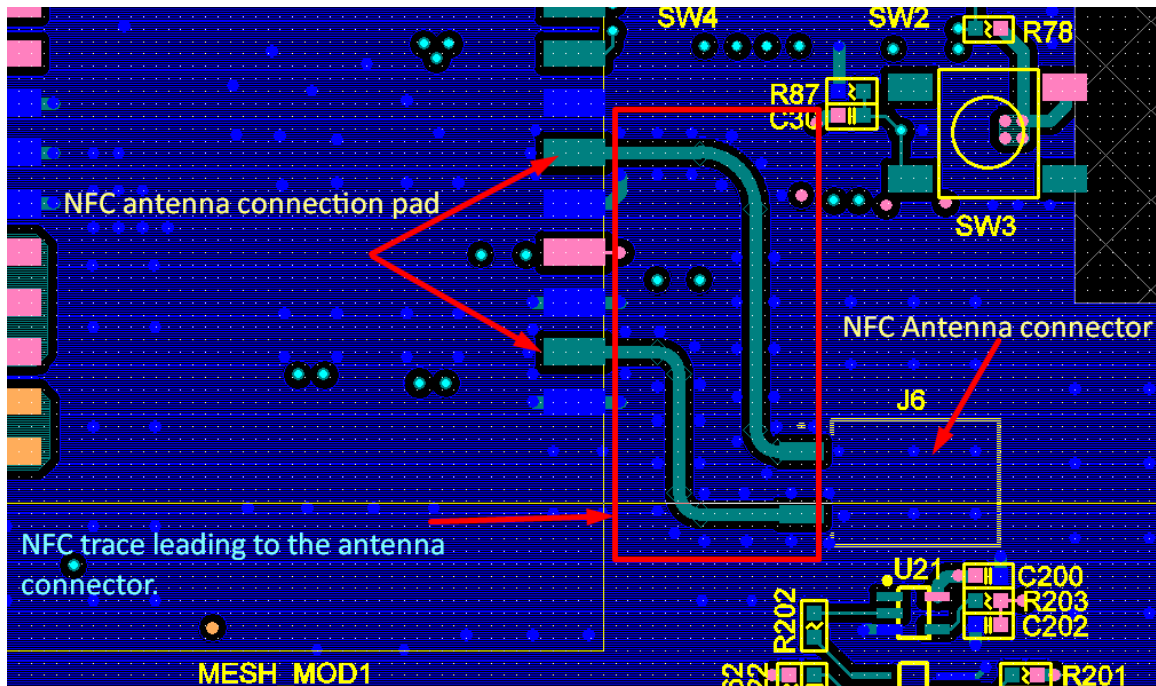
The NFC antenna used is a third-party NFC antenna manufactured by Molex, Part No. 1462360021. The NFC antenna itself can be attached to any plastic surface and in this case is attached to the bottom of the front plastic housing.

b) Appropriate parts by manufacturer and specifications.

- The antenna connector used is a Spring Contact connector by Samtec, Part No. **SIB-102-02-F-S**. The datasheet of the connector is provided
- The NFC antenna is a third party antenna by Molex and is attached to the device plastic housing. The antenna part no. is 1462360021 and the relevant datasheet is also provided

c) Test procedures for design verification. 996369 D02 Module Q and A v01 Page 5

TEST PROCEDURE FOR MODULAR DESIGN VERIFICATION

The Mesh Module is a design in a castellated PCB package so the connection to the module can be made through the castellated pads on the sides of the module. The module needs to be placed on a host PCB for design verification. The Sub1Ghz antenna connector is onboard the module hence no further RF trace design considerations are needed to be made. The NFC antenna connector is located outside the module PCB and thus care must be taken when NFC antenna PCB trace is routed to the antenna connector on the main PCB. The RF traces should be 0.5mm thick and separated by at least 2 times the trace width and properly via shielded to reduce emission and ensure proper operation. No high-speed circuitry should be placed, and traces routed near or beneath the NFC antenna connection traces.

A brief pictorial description of the NFC design verification is shown below. The module is placed on a carrier PCB according to the design layout guidelines. The NFC antenna connection trace guidelines should also be properly followed, and the approved antenna must be used.

carrier host PCB that is connected to the serial console on a PC. The NFC operation log can then be viewed on the PC via serial console. The NFC controller can be controlled by the onboard CC1352 MCU and different modes of NFC operations can be defined via I2C interface.
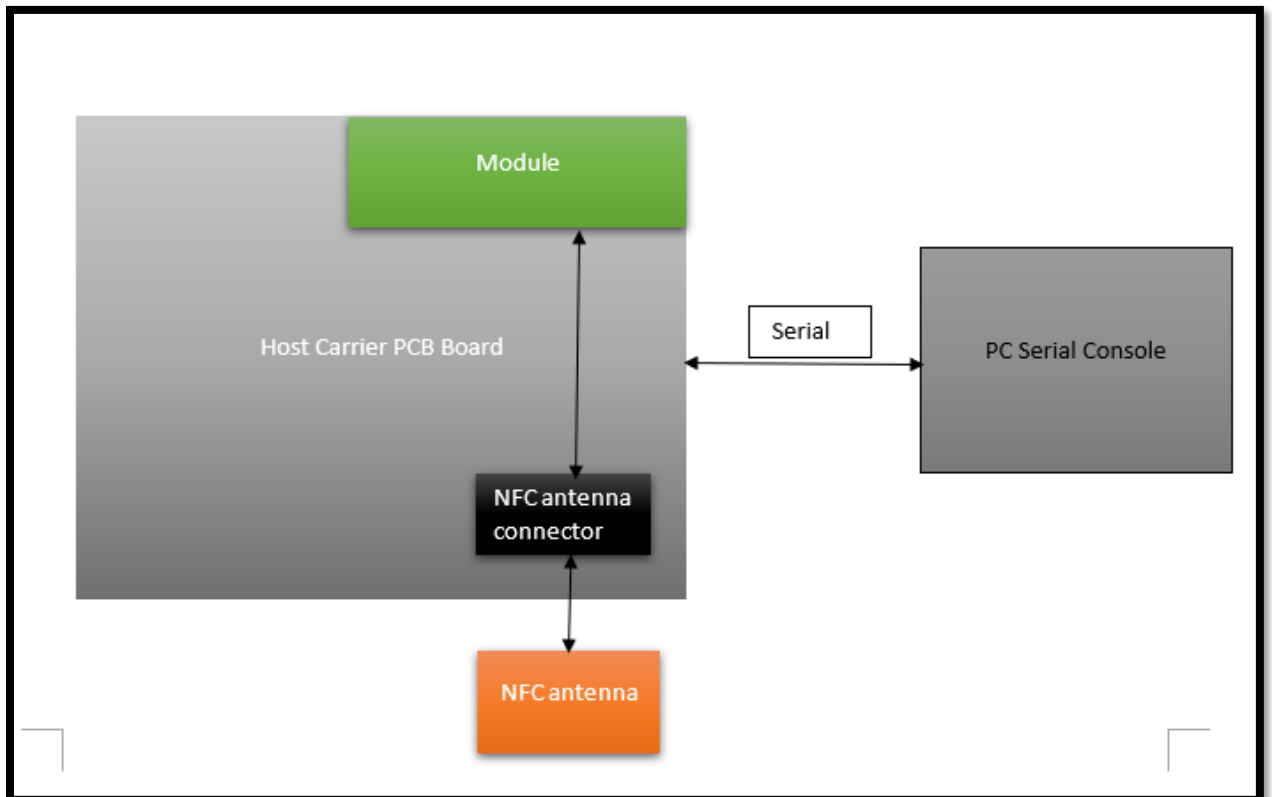
d) Production test procedures for ensuring compliance.

PRODUCTION TEST PROCEDURE

To test the device during procedure, the module placed on a carrier host PCB board as a single device can be placed inside an RF shield box to perform various RF tests to ensure compliance as shown in the image below.
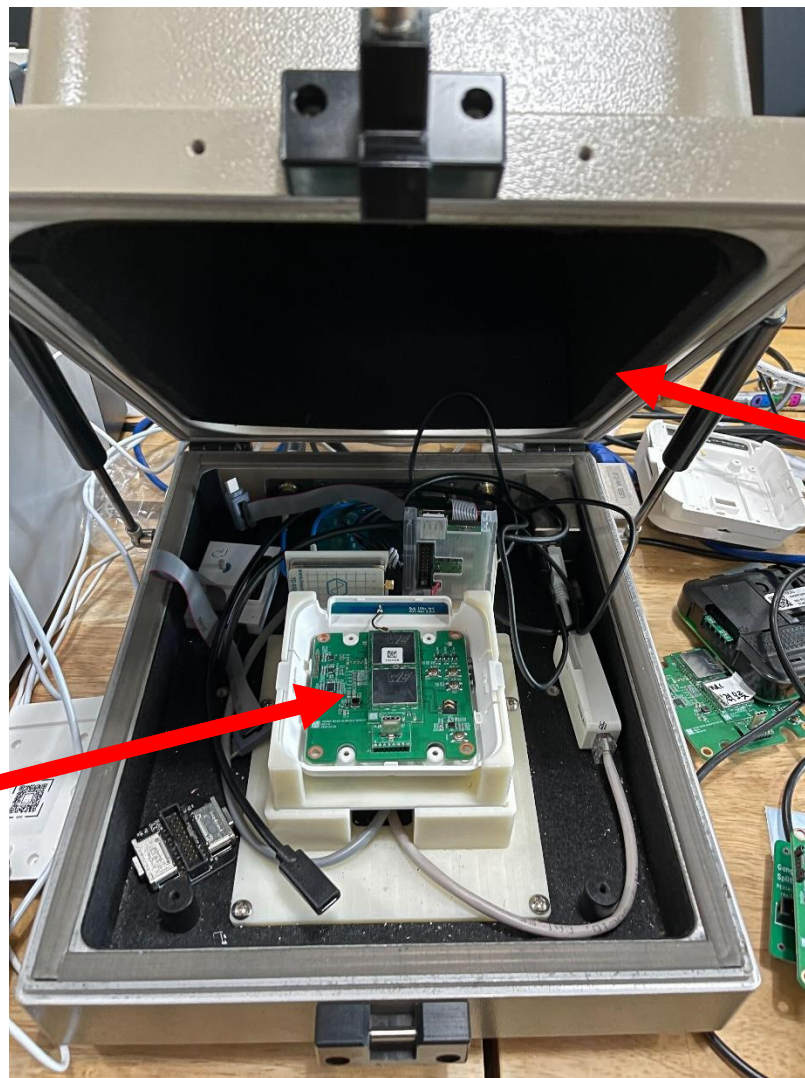
RF SHIELD BOX

MODULE ON HOST PCB

In the image above, the module residing on a host PCB is placed inside an RF shield box. The connection to the host PCB and in turn to the module is made via a serial connection that is used to input commands from a serial console on PC.

In the picture below, the module NFC antenna is attached to the device housing front cover that when put together makes contact to the NFC antenna connector on the host PCB.

NFC antenna on device front cover

A standard NFC test procedure can then be followed to test the device RF specifications and make sure that it complies with the rules stated by FCC.

Information to User

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

The AWAIRMOUNT module from BITFINDER, INC is certified for the FCC/ISED as a single-modular transmitter. The modules are FCC/ISED-certified radio modules that carries a modular grant. Users are cautioned that changes or modifications not expressively approved by the party responsible for compliance could void the authority of the user to operate the equipment.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

• This device may not cause harmful interference.

• This device must accept any interference received, including interference that may cause undesired operation of the device.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

RF Radiation Exposure Statement:

This equipment complies with FCC/ISED radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines and RSS-102 of the ISED radio frequency (RF) Exposure rules as this equipment has very low levels of RF energy.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

RSS-102 RF Exposure

L'antenne (ou les antennes) doit être installée de façon à maintenir à tout instant une distance minimum de au moins 20 cm entre la source de radiation (l'antenne) et toute personne physique.

Cet appareil ne doit pas être installé ou utilisé en conjonction avec une autre antenne ou émetteur.

IMPORTANT NOTE

This device complies with FCC & ISED radiation exposure limits set forth for an uncontrolled environment. This device should be installed and must not be co-located or operating in conjunction with any other antenna or transmitter.

This device is intended only for OEM integrators under the following conditions:

1) This module may not be co-located with any other transmitters or antennas.

2) The antenna must be installed such that 20cm is maintained between the antenna and users.

As long as 2 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 with this module installed.

In the event that these conditions cannot be met, then the FCC & IC authorizations are 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 this module and obtaining separate FCC & IC authorizations.

- End Product Labeling

To satisfy FCC exterior labeling requirements, the following text must be placed on the exterior of the end product.

Contains Transmitter module FCC ID: 2AF65AWAIRNET

IC: 28737-AWAIRNET

OEM/integrators Installation Manual
the modules limited to OEM installation only
the OEM integrator is responsible for ensuring that the end-user has no manual instruction to remove or install module.
the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.
Instructions to the OEM/integrator
The OEM integrator must include the instructions or statements required by part 15.19 and 15.21 in the user manual.
the OEM integrator must include a separate section in the host user's manual concerning the operating conditions to satisfy RF exposure compliance.

Traceability requirements information
Model Name : AWAIRNET
Product Marking Name : AWAIR MESH SURFACE MOUNT
Hardware Version: Rev 2.0
Firmware Version: 0.7.4.revc1
Manufacturer : BITFINDER, INC
Address : 315 Montgomery Street, 10th Floor, San Francisco, California, United States
Manufacturer Logo :

ISED Information to User
This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:
(1) This device may not cause interference; and (2) This device must accept any interference, including interference that may cause undesired operation of the device
Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :
(1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, meme si le brouillage est susceptible d'en compromettre le fonctionnement.

"The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application."