# FSC-BT958

**5.0 Dual Mode Bluetooth Module Datasheet**

**Version 1.0**

## Revision History

| Version | Data | Notes | |
|---------|------|-------|------|
| 1.0 | 2021/04/20 | Initial Version | Fish |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

## Contact Us

**Shenzhen Feasycom Technology Co.,LTD**

Email: sales@feasycom.com

Address: Room 2004-2005,20th Floor,Huichao Technology Building,Jinhai Road,
Xixiang ,Baoan District,Shenzhen,518100,China.
Tel: 86-755-27924639, 86-755-23062695

# Contents

# 1. INTRODUCTION

## Overview

FSC-BT958 is a multimedia system-on-chip solution with Bluetooth 5.0 dual-mode and highly integrated, dedicated to music and audio applications.

Integrating all necessary electronic components (including baseband, Bluetooth transceiver, power management) into a single system-on-chip, it provides a best-in-class bill of materials, space requirements, and cost/function ratio for Bluetooth music and audio applications.

By default, Feasycom standard firmware is built-in, and customized firmware is also available.

FSC-BT958 is a suitable product for designers who want to add wireless functions to their products.

## Features

- Compliant with Bluetooth 5.0 dual mode specification

- High power output(10dBm) Class2 and Class3 transmission supported

- UART programming and data interface (baudrate can up to 921600bps)

- Postage stamp sized form factor
- A2DP v1.3/AVRCP v1.5/HFP v1.6
- Internal LPO support for low power mode
- Echo Cancellation
- 24 bit audio processing
- HiFi Stereo Audio DAC:
    - 120Db 2NR
    - 110Db DNR
    - Supports Rates From 8 kHz to 384 kHz

- HiFi Stereo Audio ADC:
    - 100dB SNR
    - Sample Rates From 8 kHz to 384 kHz

- RoHS compliant

## Application

- True wireless stereo earbud solution

- High-end BT speaker

- Smart BT/WIFI music box

- BT docking stations and Soundbars

- BT boom box

- Other portable audio device

- IOT platform

## Module picture as below showing



**Figure 1:** FSC-BT958 Picture

## 2.  General Specification

**Table 1:** General Specifications

| Categories | Features | Implementation |
|---|---|---|
| Wireless Specification | Bluetooth Version | Bluetooth v5.0 |
| | Frequency | 2.402 - 2.480 GHz |
| | Transmit Power | +10 dBm (Maximum) |
| | Receive Sensitivity | -85 dBm@0.1%BER (Typical) |
| | Modulation | GFSK, π/4 DQPSK , 8DPSK |
| Host Interface and Peripherals | UART Interface | TX, RX, CTS, RTS |
| | | Default 115200,N,8,1 |
| | | Baudrate support from 1200 to 921600 |
| | | 5, 6, 7, 8 data bit character |
| | GPIO | 9(maximum – configurable) lines |
| Profiles | Classic Bluetooth | SPP (Serial Port Profile) - Up to 600 Kbps |
| | Bluetooth Low Energy | GATT Client & Peripheral - Any Custom Services |
| Maximum Connections | Classic Bluetooth | 1 Clients |
| | Bluetooth Low Energy | Support |
| Supply Voltage | Supply | VBAT_IN: 3.4V ~ 4.5V |
| Physical | Dimensions | 13mm(W) X 26.9mm(L) X 2.0H); Pad Pitch 1mm |
| Environmental | Operating | -20°C to +80°C |
| | Storage | -30°C to +90°C |
| Miscellaneous | Lead Free | Lead-free and RoHS compliant |
| | Warranty | One Year |
| Humidity | | 10% ~ 90% non-condensing |
| MSL grade: | | MSL 3 |
| ESD grade: | | Human Body Model:   Class-2<br>Machine Model:   Class-B |

## 3.  HARDWARE   SPECIFICATION

### 3.1   PIN Diagram

**Figure 3:** FSC-BT958 PIN Diagram(Top View)

## 3.2   PIN Definition Descriptions

**Table 2:** Pin definition

| Pin | Pin Name | Type | Pin Descriptions |
|---|---|---|---|
| 1 | GND | Vss | Power Ground |
| 2 | NC | | |
| 3 | NC | | |
| 4,12 | GPIO_03/I2S_CLK | I/O | Programmable input/output line |
| | | | Alternative Function: I2S2 synchronous data clock |
| 5,10 | GPIO_00/I2S_DI | I/O | Programmable input/output line |
| | | | Alternative Function: I2S2 synchronous data input |
| 6,11 | GPIO_02/I2S_DO | I/O | Programmable input/output line |

| | | | |
|---|---|---|---|
| | | | Alternative Function: I2S2 synchronous data output |
| 7,9 | GPIO_01/I2S_WS | I/O | Programmable input/output line |
| | | | Alternative Function: I2S2 word select |
| 8 | RESET | I | Reset if low. Pull low for minimum 5 ms to cause a reset |
| 13 | BT_TX | I/O | UART Data output |
| 14 | BT_RX | I/O | UART Data input |
| 15 | GPIO_10/BT_CTS | I/O | UART clear to send, active low |
| | | | Alternative Function: Programmable input/output line |
| 16 | GPIO_11/BT_RTS | I/O | UART request to send, active low |
| | | | Alternative Function: Programmable input/output line |
| 17 | LED0 | I/O | LED driver. (RED LED) |
| 18 | LED1 | I/O | LED driver. (BLUE LED) |
| 19 | LED2 | I/O | LED driver. (GREEN LED) |
| 20 | GPADC1 | I/O | Analogue programmable input/output line |
| 21 | NC | | |
| 22 | GND | Vss | Power Ground |
| 23 | NC | | |
| 24 | DEBUG_RX/I2C_CLK | I/O | Debug_RX |
| | | | Alternative Function2: I2C_SCL |
| 25 | DEBUG_TX/I2C_DAT | I/O | Debug_TX |
| | | | Alternative Function2: I2C_SDA |
| 26 | NC | | |
| 27 | NC | | |
| 28 | NC | | |
| 29 | NC | | |
| 30 | NC | | |
| 31 | NC | | |
| 32 | GND | Vss | Power Ground |
| 33 | VBAT_IN | Vdd | Power supply voltage 3.4V~ 4.5V(Battery positive terminal) |
| 34 | VREGENABLE | I | Power enable |
| | | | *** Chip power on input, high level/ high pules(min 10ms) is active .** |
| 35 | NC | | |
| 36 | NC | | |
| 37 | NC | | |
| 38 | NC | | |
| 39 | VCC_CHG | Vdd | Battery charger input (5V) |
| 40 | NC | | |
| 41 | NC | | |
| 42 | NC | | |
| 43 | MIC_P | I | Line or Microphone input positive |
| 44 | MIC_N | I | Line or Microphone input negative |
| 45 | MIC _BIAS | O | Microphone bias |
| 46 | SPK_RN | O | Speaker output negative, right |
| 47 | SPK_RP | O | Speaker output positive, right |

| 48 | SPK_LN | O | Speaker output negative, left |
|----|--------|---|------------------------------|
| 49 | SPK_LP | O | Speaker output positive, left |
| 50 | GND | Vss | Power Ground |
| 51 | EXT_ANT | RF | Bluetooth 50Ω transmitter output /receiver input |
| 52 | GND | Vss | Power Ground |

# 4. PHYSICAL INTERFACE

## 4.1 Power Supply

The transient response of the regulator is important. If the power rails of the module are supplied from an external voltage source, the transient response of any regulator used should be 20μs or less. It is essential that the power rail recovers quickly.

## 4.2 Audio Interfaces

### 4.2.1 Microphone Input & line IN

Check the Application Schematic for the microphone input & line IN design.
If need to use Microphone & Line IN simultaneously, please refer to the **Analog Characteristics** introduction.

### 4.2.2 SPEAKER

Check the Application Schematic for the microphone input & line IN design.
Please refer to the **Analog Characteristics** introduction.

## 4.3 Reset

The module may be reset from several sources: Power-on Reset (POR), Low level on the nRESET Pin (nRST), Debug Reset, Watchdog time-out reset (WDT), Global soft reset.

## 4.4 RF Interface

- Fully integrated RF synthesizer without any external component
- TX output power of +10dBm
- High power output(10dBm) Class2 and Class3 transmission supported
- Supports GFSK,π/4 DQPSK and 8DPSK modulation
- High performance in receiver sensitivity, -93dBm@GFSK, -95dBm@π/4 DQPSK, -87dBm@8DPSK

## 4.5    Serial Interfaces

### 4.5.1    UART

FSC-BT958 provides one channels of Universal Asynchronous Receiver/Transmitters(UART)(Full-duplex asynchronous communications). The UART Controller performs a serial-to-parallel conversion on data received from the peripheral and a parallel-to-serial conversion on data transmitted from the CPU. Each UART Controller channel supports ten types of interrupts.

This is a standard UART interface for communicating with other serial devices. The UART interface provides a simple mechanism for communicating with other serial devices using the RS232 protocol.

When the module is connected to another digital device, UART_RX and UART_TX transfer data between the two devices.

This module output is at 3.3V CMOS logic levels (tracks VCC). Level conversion must be added to interface with an RS-232 level compliant interface.

**Table 3:** Possible UART Settings

| Parameter | Possible Values | |
|---|---|---|
| Baudrate | Minimum | 1200 baud (≤2%Error) |
| | Standard | 115200bps(≤1%Error) |
| | Maximum | 921600bps(≤1%Error) |
| Flow control | Supports Automatic Flow Control (CTS and RTS lines) | |
| Parity | None, Odd or Even | |
| Number of stop bits | 1 /1.5/2 | |
| Bits per channel | 5/6/7/8 | |

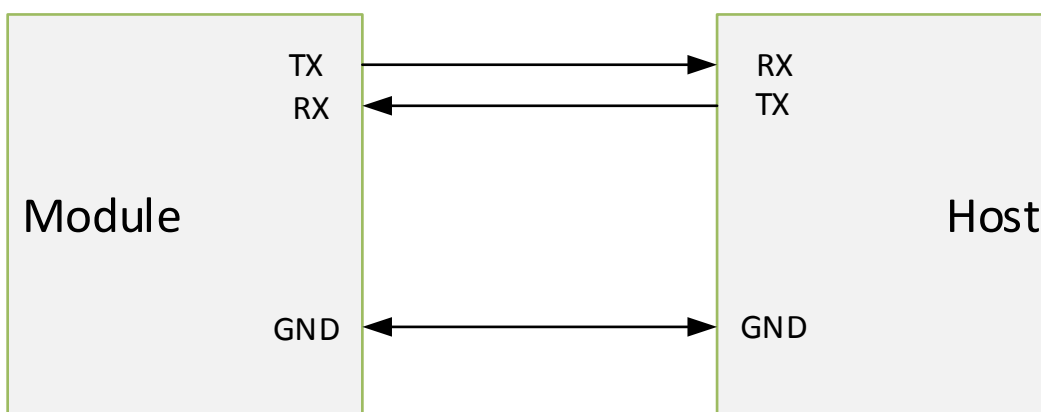When connecting the module to a host, please make sure to follow .



**Figure 4:** UART Connection

# 5. ELECTRICAL CHARACTERISTICS

## 5.1 Absolute Maximum Ratings

**Table 4:** Absolute Maximum Rating

| Parameter | Min | Type | Max | Unit |
|---|---|---|---|---|
| VBAT_IN    Input Voltage | 3.4 | 3.8 | 4.5 | V |
| $V_{IL}$    CMOS Low Level Input Voltage | 0 | | 0.3*1.8 | V |
| $V_{IH}$    CMOS High Level Input Voltage | 1.8 | | 0.7*1.8 | V |

## 5.2 Recommended Operating Conditions

**Table 5:** Recommended Operating Conditions

| Parameter | Min | Type | Max | Unit |
|---|---|---|---|---|
| VBAT_IN    Input Voltage | 3.4 | 3.8 | 4.5 | V |
| $T_A$ -    Operating Temperature | -20 | 25 | +80 | °C |
| $T_{ST}$ -    Storage Temperature | -30 | 25 | +90 | °C |
| $I_{IN}$   Input Current | -10 | | +10 | mA |

## 5.3 Audio Codec Electrical Characteristics

**Table 6:** Digital to Analogue Converter under 1.95V (b)

| Parameter | Condition | | | Min | Type | Max | Unit |
|---|---|---|---|---|---|---|---|
| Resolution | | | | | | 24 | Bits |
| Output Sample Rete, Fsample | | | | 8 | | 384 | kHz |
| SNR | fin=1kHz B/W=20Hz~20kHz A-Weighted 1Vrms Output | Fsample | Load | | | | |
| | | 48kHz | 200kΩ | | 112 | | dB |
| | | 48kHz | 32Ω | | 120 | | dB |
| | | 48kHz | 16Ω | | 120 | | dB |
| THD+N | fin=1kHz B/W=20Hz~20KHz 1Vrms Output | Fsample | Load | | | | |
| | | 8kHz | 100kΩ | | -100 | -95 | dB |
| | | 8kHz | 32Ω | | -100 | -95 | dB |
| | | 8kHz | 16Ω | | -100 | -95 | dB |
| | | 48kHz | 100kΩ | | -100 | -95 | dB |
| | | 48kHz | 32Ω | | -100 | -95 | dB |
| | | 48kHz | 16Ω | | -100 | -98 | dB |
| Digital Gain | Digital Gain Resolution = 1dB | | | -70 | | 24 | dB |
| Analogue Gain | Analogue Gain Resolution = 0.75dB | | | -18 | | 3 | dB |
| Output Voltage | 600-Ohm loading | | | | | 1000 | mV rms |
| IMD | TMTPE | | | | 93 | | |
| Freq. Response | 0.02-20kHz 30mW output | | | | | | |
| Phase | 1kHz sine wave | | | | | | |
| Pop Up Noise | | | | | | | |
| Noise Floor | A-WT Noise Gating | | | | | | |

| Noise Floor | Aduio PA on A-WT |
|---|---|
| Crosstalk | 100Hz,1Vrms Output |
| Crosstalk | 1KHz,1Vrms Output |
| Crosstalk | 10KHz,1Vrms Output |
| DNR | A-Weight,32Ω |

(a) SNR is the ratio of output level with a 1-kHz full-scale input, to the output level playing an all-zero signal, measured A-weighted over a 20-Hz to 20-kHz bandwidth.

(b) The BES2300-L provides a digital noise gate function for each of the output signal paths. The noise gate ensures best noise performance when the signal path is idle. When the noise gate is enabled, and the applicable signal level is below the noise gate threshold, then the noise gate is activated, causing the signal path to be muted.

**Table 7:** Codec - Analogue to Digital Converter under 1.95V

| Parameter | Condition | | Min | Type | Max | Unit |
|---|---|---|---|---|---|---|
| Resolution | | | | | 24 | Bits |
| Output Sample Rete, Fsample | | | 8 | | 384 | kHz |
| SNR | fin=1kHz B/W=20Hz~20kHz A-Weighted 0.7Vrms Input | Fsample | | | | |
| | | 48kHz | | 100 | | dB |
| THD+N | fin=1kHz B/W=20Hz~20KHz 1Vrms Output | Fsample | | | | |
| | | 48kHz | | -95 | | dB |
| Digital Gain | Digital Gain Resolution = 1dB | | -30 | | 30 | dB |
| Analogue Gain | Analogue Gain Resolution = 3dB | | -9 | | 12 | dB |

# 6.  MSL & ESD

**Table 8:** MSL and ESD

| Parameter | Value |
|---|---|
| MSL grade: | MSL 3 |
| ESD grade: | Human Body Model:   Class-2<br>Machine Model:   Class-B |

# 7.  RECOMMENDED TEMPERATURE REFLOW PROFILE

Prior to any reflow, it is important to ensure the modules were packaged to prevent moisture absorption. New packages contain desiccate (to absorb moisture) and a humidity indicator card to display the level maintained during storage and shipment. If directed to bake units on the card, please check the below **next table** and follow instructions specified by IPC/JEDEC J-STD-033.

**Note:** The shipping tray cannot be heated above 65°C. If baking is required at the higher temperatures displayed in the below **next table**, the modules must be removed from the shipping tray.

Any modules not manufactured before exceeding their floor life should be re-packaged with fresh desiccate and a new humidity indicator card. Floor life for MSL (Moisture Sensitivity Level) 3 devices is 168 hours in ambient environment

30°C/60%RH.

**Table 9**: Recommended baking times and temperatures

| MSL | 125°C Baking Temp. | | 90°C/≤ 5%RH Baking Temp. | | 40°C/ ≤ 5%RH Baking Temp. | |
|---|---|---|---|---|---|---|
| | Saturated @ 30°C/85% | Floor Life Limit + 72 hours @ 30°C/60% | Saturated @ 30°C/85% | Floor Life Limit + 72 hours @ 30°C/60% | Saturated @ 30°C/85% | Floor Life Limit + 72 hours @ 30°C/60% |
| 3 | 9 hours | 7 hours | 33 hours | 23 hours | 13 days | 9 days |

Feasycom surface mount modules are designed to be easily manufactured, including reflow soldering to a PCB. Ultimately it is the responsibility of the customer to choose the appropriate solder paste and to ensure oven temperatures during reflow meet the requirements of the solder paste. Feasycom surface mount modules conform to J-STD-020D1 standards for reflow temperatures.

The soldering profile depends on various parameters necessitating a set up for each application.   The data here is given only for guidance on solder reflow.
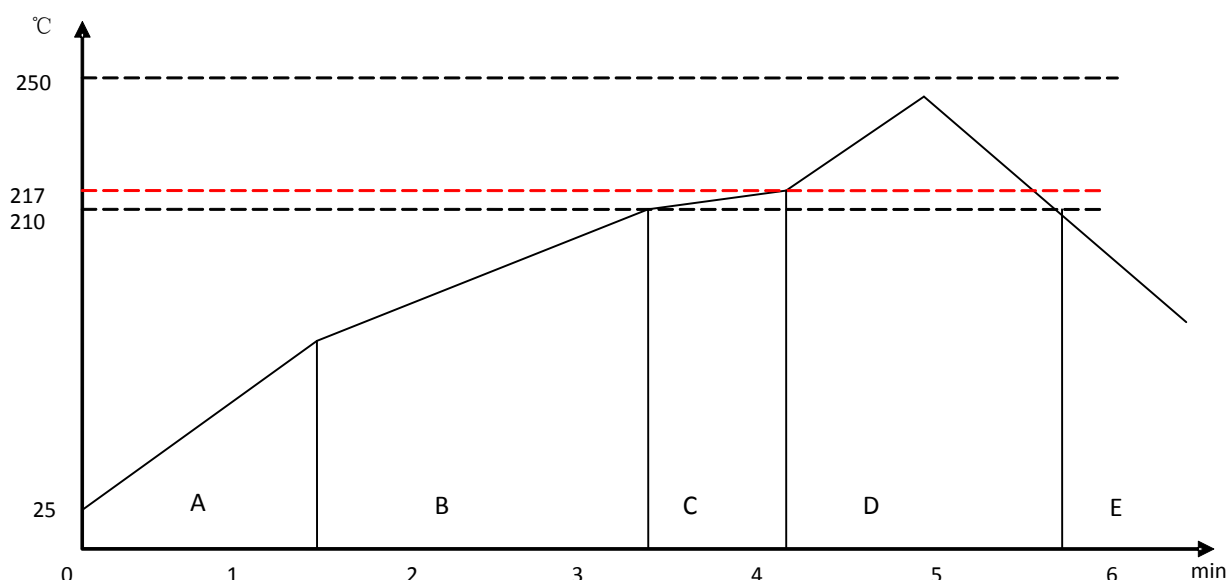


**Figure 5:** Typical Lead-free Re-flow

**Pre-heat zone (A)** — This zone raises the temperature at a controlled rate, **typically 0.5 – 2 °C/s**.   The purpose of this zone is to preheat the PCB board and components to 120 ~ 150 °C.   This stage is required to distribute the heat uniformly to the PCB board and completely remove solvent to reduce the heat shock to components.

**Equilibrium Zone 1 (B)** — In this stage the flux becomes soft and uniformly encapsulates solder particles and spread over PCB board, preventing them from being re-oxidized.   Also with elevation of temperature and liquefaction of flux, each activator and rosin get activated and start eliminating oxide film formed on the surface of each solder particle and PCB board. **The temperature is recommended to be 150° to 210° for 60 to 120 second for this zone.**

**Equilibrium Zone 2 (C) (optional)** — In order to resolve the upright component issue, it is recommended to keep the temperature in 210 – 217 ° for about 20 to 30 second.

**Reflow Zone (D)** — The profile in the figure is designed for Sn/Ag3.0/Cu0.5.   It can be a reference for other lead-free solder. The peak temperature should be high enough to achieve good wetting but not so high as to cause component discoloration or damage. Excessive soldering time can lead to intermetallic growth which can result in a brittle joint. The recommended peak temperature (Tp) is 230 ~ 250 °C.   The soldering time should be 30 to 90 second when the temperature is above 217 °C.

**Cooling Zone (E)** — The cooling ate should be fast, to keep the solder grains small which will give a longer-lasting joint. **Typical cooling rate should be 4 °C.**

# 8. MECHANICAL DETAILS

## 8.1 Mechanical Details

- Dimension:    13mm(W) x 26.9mm(L) x 2.0mm(H) Tolerance: ±0.1mm
- Module size:    13mm X 26.9mm    Tolerance: ±0.2mm
- Pad size:    1.6mmX0.6mm    Tolerance: ±0.2mm
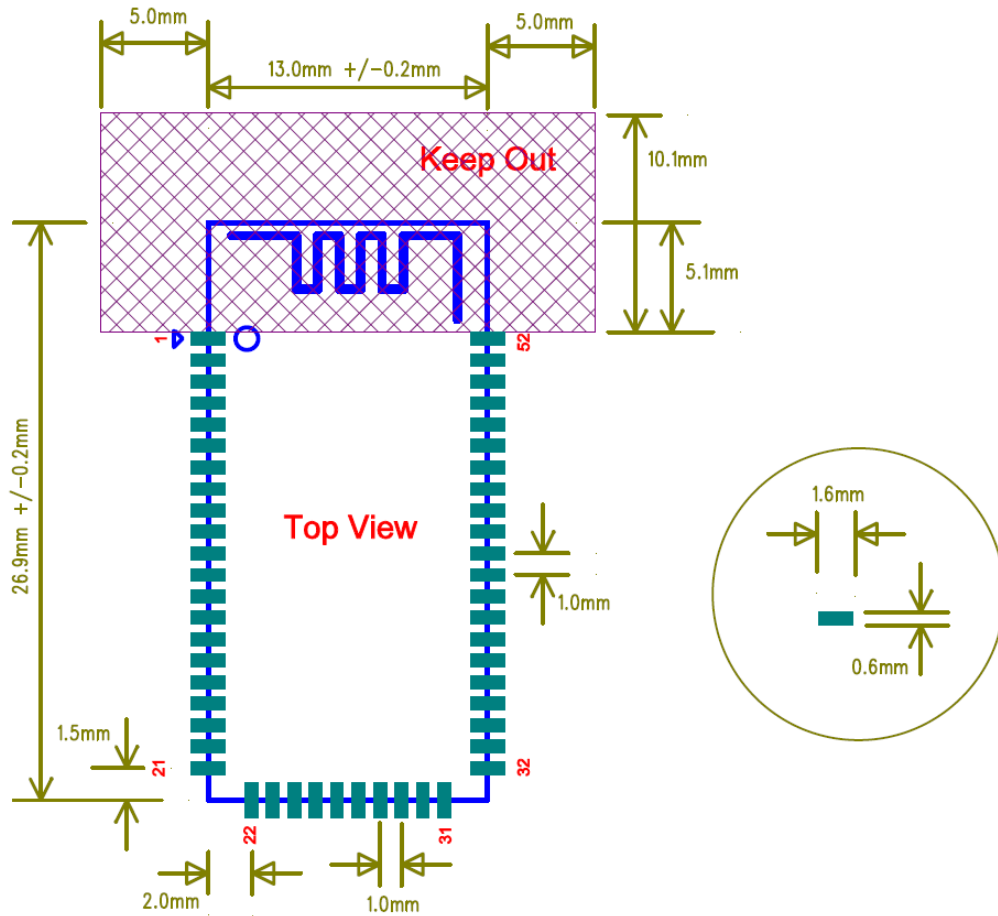- Pad pitch:    1.0mm    Tolerance: ±0.1mm

**Figure 6:** FSC-BT958 footprint

# 9. HARDWARE INTEGRATION SUGGESTIONS

## 9.1 Soldering Recommendations

FSC-BT1006A is compatible with industrial standard reflow profile for Pb-free solders. The reflow profile used is dependent on the thermal mass of the entire populated PCB, heat transfer efficiency of the oven and particular type of solder paste used. Consult the datasheet of particular solder paste for profile configurations.

Feasycom will give following recommendations for soldering the module to ensure reliable solder joint and operation of the module after soldering. Since the profile used is process and layout dependent, the optimum profile should be studied case by case. Thus following recommendation should be taken as a starting point guide.

## 9.2 Layout Guidelines(Internal Antenna)

It is strongly recommended to use good layout practices to ensure proper operation of the module. Placing copper or any metal near antenna deteriorates its operation by having effect on the matching properties. Metal shield around the antenna will prevent the radiation and thus metal case should not be used with the module. Use grounding vias separated max 3 mm apart at the edge of grounding areas to prevent RF penetrating inside the PCB and causing an unintentional resonator. Use GND vias all around the PCB edges.

The mother board should have no bare conductors or vias in this restricted area, because it is not covered by stop mask print. Also no copper (planes, traces or vias) are allowed in this area, because of mismatching the on-board antenna.
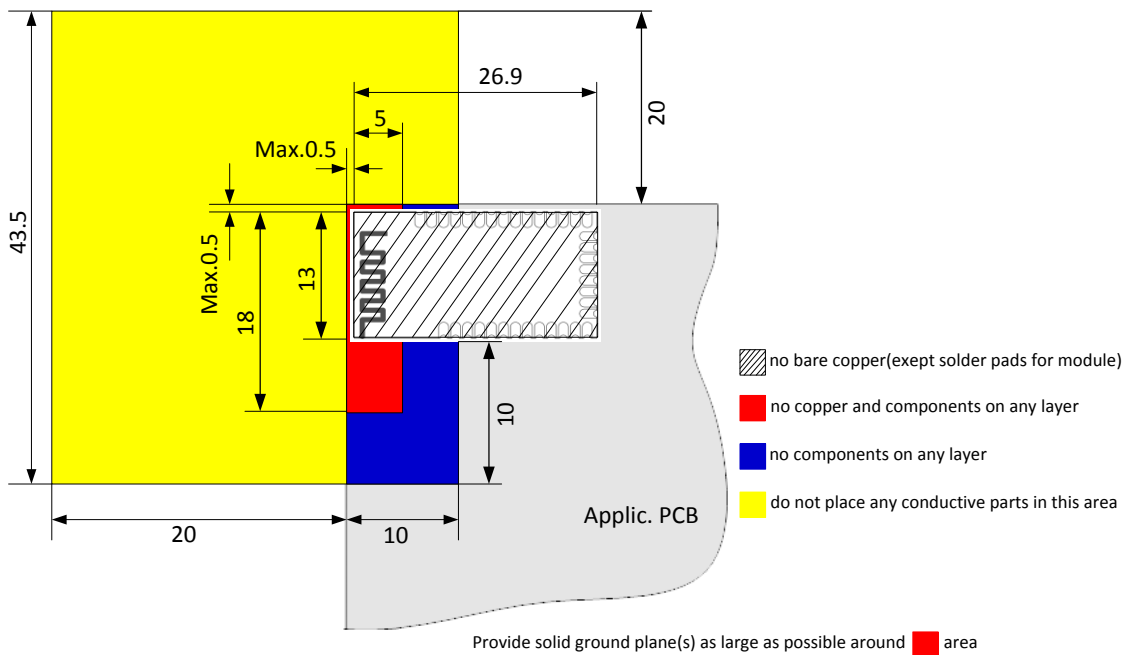


**Figure 7:** FSC-BT1006A Restricted Area

Following recommendations helps to avoid EMC problems arising in the design. Note that each design is unique and the following list do not consider all basic design rules such as avoiding capacitive coupling between signal lines. Following list is aimed to avoid EMC problems caused by RF part of the module. Use good consideration to avoid problems arising from digital signals in the design.

Ensure that signal lines have return paths as short as possible. For example if a signal goes to an inner layer through a via, always use ground vias around it. Locate them tightly and symmetrically around the signal vias. Routing of any sensitive signals should be done in the inner layers of the PCB. Sensitive traces should have a ground area above and under the line. If this is not possible, make sure that the return path is short by other means (for example using a ground line next to the signal line).

## 9.3    Layout Guidelines(External Antenna)

Placement and PCB layout are critical to optimize the performances of a module without on-board antenna designs. The trace from the antenna port of the module to an external antenna should be 50Ω and must be as short as possible to avoid any interference into the transceiver of the module.   The location of the external antenna and RF-IN port of the module should be kept away from any noise sources and digital traces. A matching network might be needed in between the external antenna and RF-IN port to better match the impedance to minimize the return loss.

As indicated in **Figure**    below, RF critical circuits of the module should be clearly separated from any digital circuits on the system board.   All RF circuits in the module are close to the antenna port.   The module, then, should be placed in this way that module digital part towards your digital section of the system PCB.
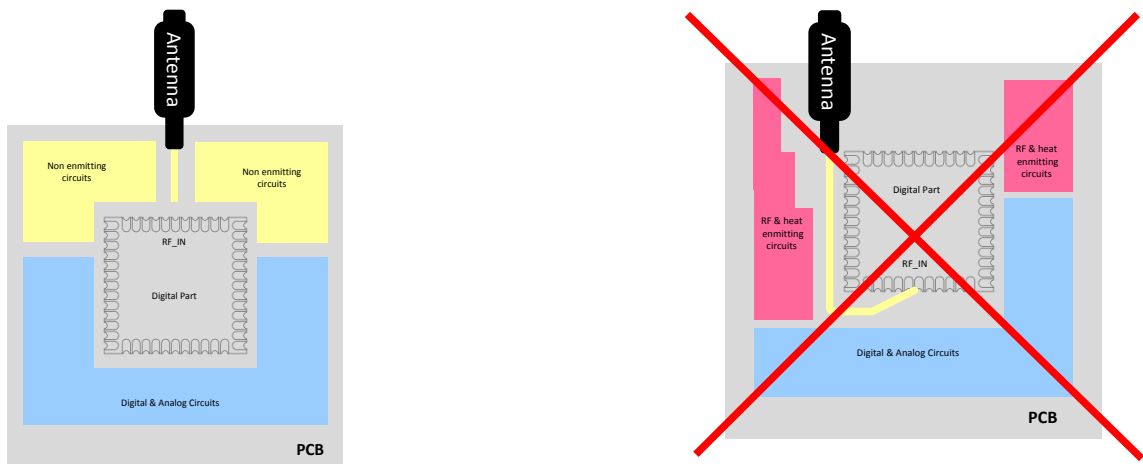


**Figure 8:** Placement the Module on a System Board

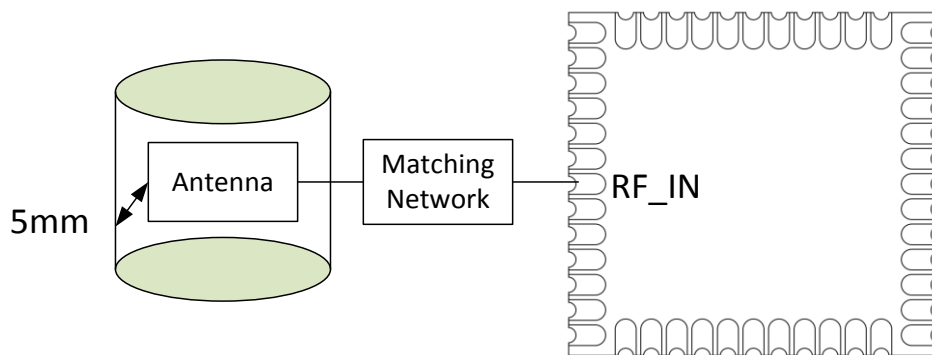## 9.3.1    Antenna Connection and Grounding Plane Design



**Figure 9:** Leave 5mm Clearance Space from the Antenna

General design recommendations are:

- The length of the trace or connection line should be kept as short as possible.

- Distance between connection and ground area on the top layer should at least be as large as the dielectric thickness.

- Routing the RF close to digital sections of the system board should be avoided.

- To reduce signal reflections, sharp angles in the routing of the micro strip line should be avoided. Chamfers or fillets are preferred for rectangular routing; 45-degree routing is preferred over Manhattan style 90-degree routing.
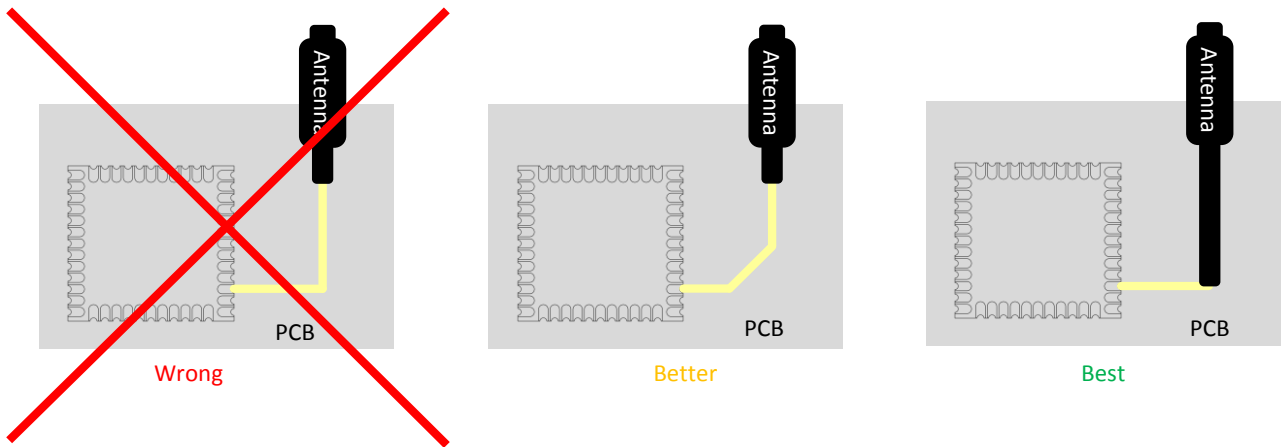


**Figure 10:** Recommended Trace Connects Antenna and the Module

- Routing of the RF-connection underneath the module should be avoided. The distance of the micro strip line to the ground plane on the bottom side of the receiver is very small and has huge tolerances. Therefore, the impedance of this part of the trace cannot be controlled.

- Use as many vias as possible to connect the ground planes.

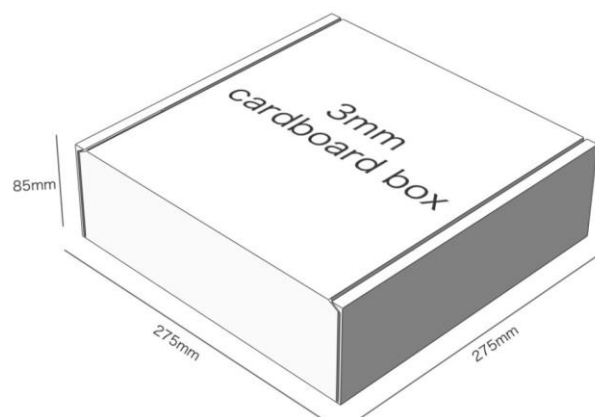# 10.  PRODUCT PACKAGING INFORMATION

## 10.1  Default Packing

a, Tray vacuum

b, Tray Dimension: 180mm * 195mm

**Figure 11:** Tray vacuum

## 10.2    Packing box(Optional)



* If require any other packing, must be confirmed with customer

* Package: 1000PCS Per Carton (Min Carton Package)

**Figure 12:** Packing Box

# 11.  APPLICATION SCHEMATIC

**Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01**

**2.2 List of applicable FCC rules**

FCC Part 15.247

**2.3 Specific operational use conditions**

This transmitter/module and its antenna(s) must not be co-located or operating in conjunction with any    transmitter. This information also extends to the host manufacturer's instruction manual.

**2.4 Limited module procedures**

not applicable

**2.5 Trace antenna designs**

not applicable

**2.6 RF exposure considerations**

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This compliance to FCC radiation exposure limits for an uncontrolled environment, and minimum of 5mm separation between antenna and body.

The host product manufacturer would provide the above information to end users in their end-product manuals.

**2.7 Antennas**

PCB antenna; 2dBi; 2.402 GHz～2.480GHz

**2.8 Label and compliance information**

The end product must carry a physical label or shall use e-labeling followed KDB784748D01 and KDB 784748 stating "Contains Transmitter Module FCC ID: 2AMWOFSC-BT958".

**2.9 Information on test modes and additional testing requirements**

For more information on testing, please contact the manufacturer.

**2.10 Additional testing, Part 15 Subpart B disclaimer**

The modular transmitter is only FCC authorized for the specific rule parts (FCC Part 15.247) listed 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.

## FCC Statements

(OEM) Integrator has to assure compliance of the entire end-product incl. the integrated RF Module. For 15 B (§15.107 and if applicable §15.109) compliance, the host manufacturer is required to show compliance with 15 while the module is installed and operating.

Furthermore the module should be transmitting and the evaluation should confirm that the module's intentional emissions (15C) are compliant (fundamental / out-of-band). Finally the integrator has to apply the appropriate equipment authorization (e.g. Verification) for the new host device per definition in §15.101.

Integrator is reminded to assure that these installation instructions will not be made available to the end-user of the final host device.

The final host device, into which this RF Module is integrated" has to be labeled with an auxiliary label stating the FCC ID of the RF Module, such as "Contains FCC ID: 2AMWOFSC-BT958

"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."

"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."

the Integrator will be responsible to satisfy SAR/ RF Exposure requirements, when the module integrated into the host device.

## Module statement

The single-modular transmitter is a self-contained, physically delineated, component for which compliance can be demonstrated independent of the host operating conditions, and which complies with all eight requirements of § 15.212(a)(1) as summarized below.

1) The radio elements have the radio frequency circuitry shielded.
2) The module has buffered modulation/data inputs to ensure that the device will comply with Part 15 requirements with any type of input signal.
3) The module contains power supply regulation on the module.
4) The module contains a permanently attached antenna.
5) The module demonstrates compliance in a stand-alone configuration.
6) The module is labeled with its permanently affixed FCC ID label.
7) The module complies with all specific rules applicable to the transmitter, including all the conditions provided in the integration instructions by the grantee.
8) The module complies with RF exposure requirements.

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