# FCL Components Wireless modules

## Mesh Sensor Unit (Wirepas Mesh 2.4 GHz based)

## FWM8BLZ08C-109132 Datasheet

Ver. 2
Feb 1, 2024

FCL Components Limited

**All specifications are preliminary which may be changed without any prior notice**

# 1. Summary

This datasheet applies to the Wirepas Mesh 2.4 GHz based Mesh Sensor Unit FWM8BLZ08C.

# 2. Features

This product is an antenna integrated Mesh Sensor Unit which incorporates Wirepas Mesh 2.4 GHz. It is possible to communicate ISM (Industrial Scientific Medical) band.

Since Wirepas Mesh 2.4 GHz is a wireless mesh network technology that enables wireless IoT networking at massive scale, this product is suitable for building sensor network with integrated temperature, humidity, pressure, illuminance, ambient sound level and CO2 sensor.

The followings are the key features.

- Wirepas Mesh 2.4 GHz enabled
- Dimension : 76.5mm x 74.2mm x 29.0mm
- Weight : 65 g
- Operating Temperature : -10 to +60 °C
- Operating Humidity : +20 to +80 %RH (Noncondensing)
- Integrated sensors : Temperature, humidity, pressure, accelerometer, illuminance, microphone (Sound level) and CO2
- Water resistant and dustproof : IP65
- Power Supply : +5V via USB type-C connector

Functions:

- Transmission of temperature, humidity, pressure, ambient light, sound level and CO2 data on mesh network.
- Status display by LED indicator
- Configurable by App config message or Remote API.

## 3. Applicable Standard

- Wirepas Mesh 2.4 GHz v5
- FCC, ISED certification

    FWM8BLZ08C contains the certificated module (FWM7BLZ20B).

    FCC ID of the certificated module: SQK-7BLZ20

    ISED ID of the certificated module: 337L-7BLZ20

- CE, UKCA Marking
- ARIB STD-T66

    Radio Act (Japan) Certification No. 007-AG0232

- (Certificated by the combination of embedded module.) RCM, R-NZ certification
- RCM, R-NZ certification
- RoHS Compliant

## 4. Block Diagram
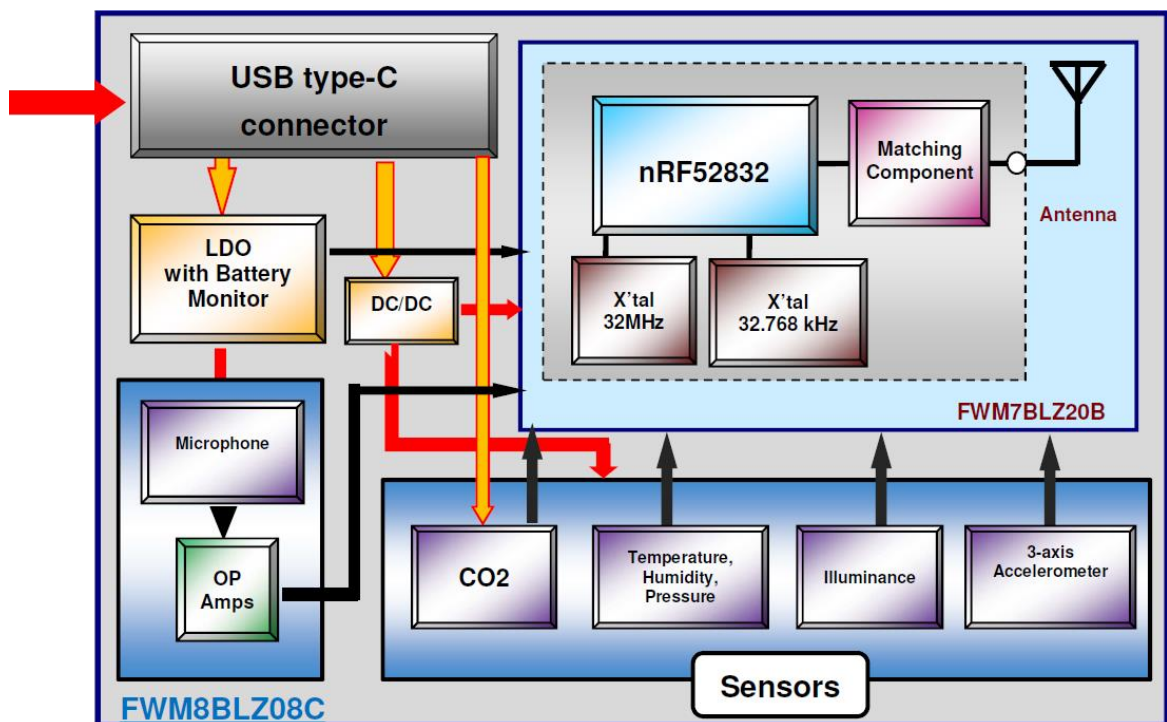


Figure 4-1: Block Diagram

## 5. Electrical Characteristics

### 5-1. General Features

Wirepas Mesh 2.4 GHz enabled

| | | |
|---|---|---|
| Carrier frequency | : | 2400 MHz to 2483.5 MHz |
| Modulation | : | GFSK |
| Data rate | : | 1 Mbps |
| Modulation index | : | 0.5 |
| Channel | : | 40 channels |
| Channel spacing | : | 2 MHz |
| Output power | : | +4 dBm max |

### 5-2. Absolute Maximum Rating

| Items | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Supply Voltage (VDD) | VDD | -0.3 | 5.5 | V |
| Supply Voltage (GND) | GND | - | 0 | V |
| Storage Temperature | Tstg | -10 | +60 | °C |
| Acceleration (Any axis) | | | 20,000 g for 0.2msec | |

### 5-3. Recommended Operating Condition

| Items | Symbol | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|
| Operating Voltage* | VDD | 4.5 | 5.0 | 5.5 | V |
| Operating Temperature | Ta | -10 | 25 | +60 | °C |
| Operating Humidity** | Hopr | 20 | - | 80 | %RH |

* If the input voltage is less than 4.3V, FWM8BLZ08C will stop $CO_2$ measurement to prevent malfunction. (FW version: BB or later).

** No dew condensation

### 5-4. General radio characteristics

Ta=25±2°C

| Items | Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|
| Operating frequencies | 2MHz channel spacing | 2400 | - | 2483.5 | MHz |
| PLL programming resolution | | | 1 | | MHz |
| Frequency deviation | | | ±250 | | kHz |

### 5-5. Transmitter Specifications

Ta=-10°C to 60°C

| Items | Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|
| Output power | | -20 | | +4 | dBm |
| Step size of RF power control | | | 4 | | dB |
| RF power control range | | | +24 | | dB |

### 5-6. Receiver sensitivity

Ta=-10°C to 60°C

| Items | Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|
| Maximum received signal strength | < 30.8% PER | | 0 | | dBm |
| Receiver sensitivity | Dirty transmitter < 30.8% PER | | -94 | | dBm |

Receiver specifications

<div align="right">Ta=25±2°C</div>

| Items | Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|
| RX selectivity (C/I performance) | Co-channel interference | | 6 | | dB |
| | Adjacent (-1 MHz) interference | | -2 | | dB |
| | Adjacent (+1 MHz) interference | | -9 | | dB |
| | Adjacent (-2 MHz) interference | | -22 | | dB |
| | Adjacent (+2 MHz) interference | | -46 | | dB |
| | Adjacent (>= 3 MHz) interference | | -50 | | dB |
| | Image frequency interference | | -22 | | dB |
| | Adjacent (1 MHz) interference to in-band image frequency | | -35 | | dB |
| RX intermodulation | IMD performance (3 MHz, 4 MHz, and 5 MHz offset) | | -30 | | dBm |

## 5-7.      Current Consumption

### 5-7-1.  Current consumption of RF part

<div align="right">Vin=3.0V ,Ta=25±2°C</div>

| Description | Symbol | Typ. | Max. | Unit |
|---|---|---|---|---|
| TX current @ $P_{OUT}$ = +4 dBm | $I_{TX,+4dBM}$ | 10.9 | 16.0 | mA |
| TX current @ $P_{OUT}$ = 0 dBm | $I_{TX,0dBM}$ | 8.0 | 12.0 | mA |
| TX current @ $P_{OUT}$ = -4 dBm | $I_{TX,-4dBM}$ | 7.3 | 11.0 | mA |
| TX current @ $P_{OUT}$ = -8 dBm | $I_{TX,-8dBM}$ | 6.6 | 10.0 | mA |
| TX current @ $P_{OUT}$ = -12 dBm | $I_{TX,-12dBM}$ | 6.3 | 9.5 | mA |
| TX current @ $P_{OUT}$ = -16 dBm | $I_{TX,-16dBM}$ | 6.1 | 9.0 | mA |
| RX current | $I_{RX}$ | 11.2 | 16.3 | mA |
| Deep Sleep current | $I_{SLEEP}$ | 5.5 | | uA |

### 5-7-2.  Average current consumption of Sensor (reference value)

<div align="right">Ta=25±2°C</div>

| Description | Symbol | Typ. | Max. | Unit |
|---|---|---|---|---|
| Temperature, Humidity, Barometric Pressure | | 6 | | uA |
| Illuminance | | 3 | | uA |
| Sound level | | 8 | | uA |
| 3-axis Acceleration | | 2 | | uA |
| CO2 sensor | | 14 | | mA |

Note: Measurement interval: 10sec

5-8. **Sensor specification**

This product is integrated with

- Environmental sensor (Temperature, Humidity, Barometric pressure)
- Illuminance sensor
- Microphone (Sound level)
- 3-axis acceleration sensor
- CO2 sensor

The specifications of each sensor are shown in the next section. However, the characteristics will change depending on the usage environment, so please refer to them as reference values. FCL Components does not guarantee the characteristics.

5-8-1.  **Temperature sensor**

| Items | Symbol | Min | Typ. | Max | Unit |
|-------|--------|-----|------|-----|------|
| Full-Scale Range | | -40 | | +85 | °C |
| Absolute accuracy temperature | $A_{T,25}$ | | ±0.5 | | °C |
| | $A_{T,}$ 0 to 65°C | | ±1.0 | | °C |
| Output resolution | $R_T$ | | 0.01 | | °C |

5-8-2.  **Humidity sensor**

| Items | Symbol | Min | Typ. | Max | Unit |
|-------|--------|-----|------|-----|------|
| Full-Scale Range | | 0 | | 100 | %RH |
| Absolute accuracy tolerance | $A_H$ 25°C, 20 to 80%RH | | ±3.0 | | %RH |
| Hysteresis[1] | $H_H$ | | ±1.0 | | %RH |
| Output resolution | $R_T$ | | 0.01 | | %RH |

5-8-3.  **Barometric pressure**

| Items | Symbol | Min | Typ. | Max | Unit |
|-------|--------|-----|------|-----|------|
| Full-Scale Range | | 300 | | 1,100 | hPa |
| Absolute accuracy tolerance | $A_{P,full}$ 0 to 65°C, 300 to 1000hPA | | ±1.0 | | hPa |
| Output resolution | $R_T$ | | 0.01 | | hPa |

5-8-4.  **Illuminance sensor**

| Items | Symbol | Min | Typ. | Max | Unit |
|-------|--------|-----|------|-----|------|
| Full-Scale Range | | 0 | | 10,000 | Lx |
| Output resolution | | | 1 | | Lx |

### 5-8-5. Microphone (Sound level)

| Items | Symbol | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|
| Full-Scale Range | | 0 | | 90 | dB SPL |
| Output resolution | $R_T$ | | 1 | | dB SPL |

Note : Microphone characteristics are affected by installing condition and surrounding environment (indoor, outdoor, placement of shields etc.).

Therefore, it is recommended to check the characteristics in your environment before use.

### 5-8-6. 3-axis Acceleration sensor

| Items | Symbol | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|
| ACCELEROMETER SENSITIVITY | | | | | |
| Full-Scale Range | | 0 | | ±16 | G |
| Output resolution | | | 0.001 | | G |

The axial direction is shown below.
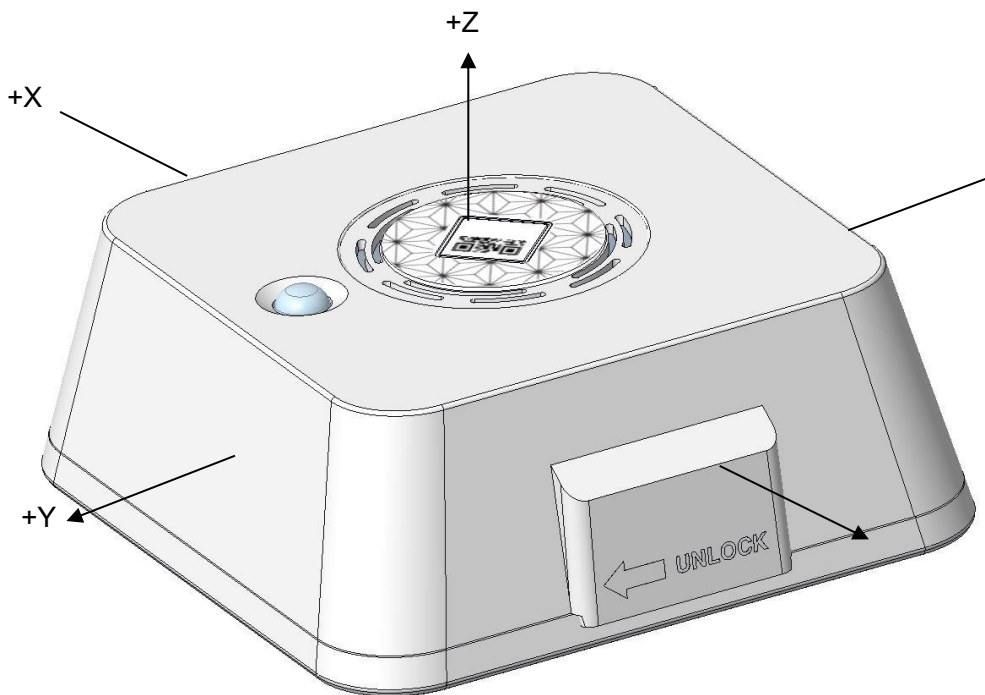
### 5-8-7. CO2 sensor

| Items | Symbol | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|
| Full-Scale Range | | 0 | | 40,000 | ppm |
| Accuracy at 400 ppm – 5'000 ppm | | | ±40ppm ±5% reading | | ppm |
| Response time | | | 60 | | Sec |

# 6. Interface specifications

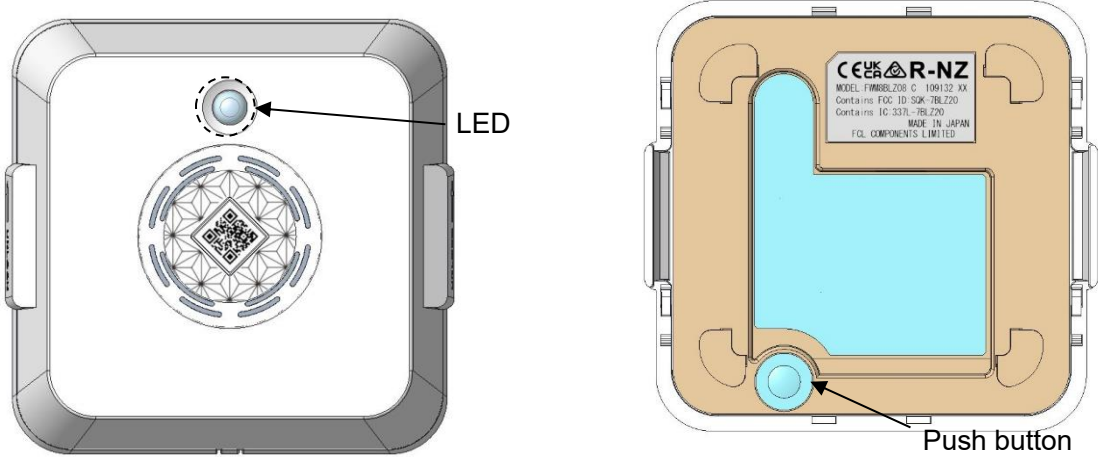## 6-1. Hardware Interface



LED

Push button

Figure 6-1: Hardware Interface

# 7. Function Specification

## 7-1. Operation Mode

This product has two types of operation modes shown in the table below, and the modes can be switched by operating the push button at startup.

| Operation Mode | Description |
|---|---|
| Mode 1 (Normal mode) | This mode is intended for use in normal operation. |
| Mode 3 (Recovery mode) | Deletes all settings and restores the default firmware. |

Various operation settings of this product can be changed.

Settings can be changed using the Wirepas Terminal or Wirepas Network Tool.

(Settings can also be changed using the AppConfig function or Remote API.)

### 7-1-1. Mode 1 (Normal mode)

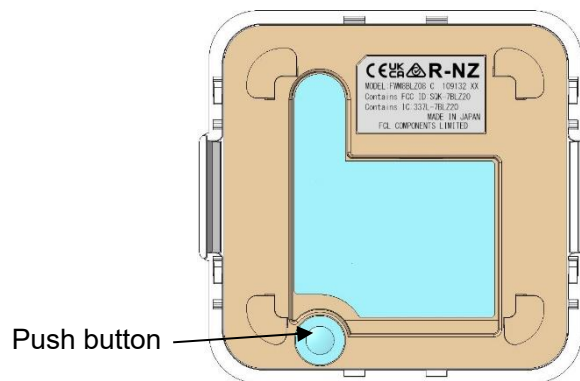| Operating Instructions | Push Button | LED |
|---|---|---|
| Turn on the unit. *Please don't touch the push button during this process. | OFF | OFF |
| | | Blinking (2 seconds) |
| | | OFF |



Push button

Figure 7-1: Mode 1

Behavior of Mode 1

After the unit is turned on, the LED indicator blinks for first 2 seconds. This LED blinking feature can't be changed.

Afterwards, The LED will continue flashing. The color of the LED indicates that the level of $CO_2$ concentration.

Please refer to "Wirepas Mesh Sensor Unit Firmware Specification" for details.

### 7-1-2. **Mode 3 (Recovery mode)**

| Operating Instructions | Push Button | LED |
|---|---|---|
| Turn on the unit with the push button pressed. After 2 seconds, the LED turns on. | ON | OFF |
| | | OFF (2 seconds) |
| | | ON |
| Keep pressing the push button after the LED turns on.<br>Release the push button within 5 seconds after the LED starts to flash.<br>All the settings are restored to default settings and it reboots automatically. | | ON (15 seconds) |
| | | Blinking (within 5 seconds) |
| | OFF | |

If the push button is not released within 5seconds after the LED starts blinking, the unit will boot in Mode 1.
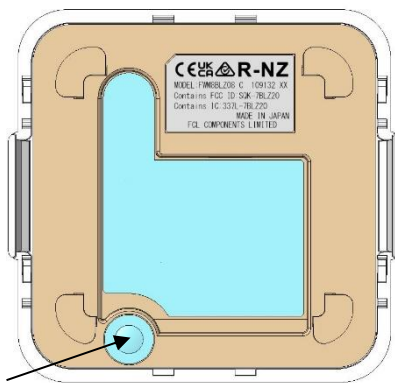


Push button          Figure 7-2: Mode 3

Behavior of Mode 3

The recovery mode is a function that aims to forcibly restore it to the initial settings when it is out of control due to a reason such as "Inappropriate settings are done to the product".

This deletes all the settings and restores the firmware to initial settings. It reboots automatically after the recovery.

### 7-1-3. **Function of Push button and LED**

The push button is used to switch the operation mode (Mode 1, Mode 3: recovery mode) at startup.

The LED indicator shows the status when switching the operation mode.

## 8. Firmware

### 8-1. Firmware version

| Revision * | Firmware version<br>(Base version of Wirepas firmware is given in parenthesis). | App_version | App_specific_area_id |
|---|---|---|---|
| AA | wp_v1.00A_v5_** (05.01.00.61) | 1.0.0.0 | 0xFC1083 |
| BB | wp_v1.01A_v5_** (05.01.00.61) | 1.01.0.0 | 0xFC1083 |
| CC | wp_v2.00A_v5_** (05.03.00.89) | 2.0.0.0 | 0xFC1083 |

\* Please refer to 9-3 Label specification.

## 8-2. **Initial setting**

Initial setting is as follows.

| Parameter | Value |
|---|---|
| Node Address | Random number (4 byte) |
| Network Address | 7986085 (0x79DBA5) |
| Network Channel | 10 |
| ENCRIPTION_KEY_EN | 0 (disable) |
| ENCRIPTION_KEY_VALUE | - |
| AUTHENTICATION_KEY_EN | 0 (disable) |
| AUTHENTICATION_KEY_VALUE | - |
| EP_BASE_NUM | 0x06 |
| NODE ROLE | 0x41 (Autorole Low Energy Router) |
| POS_OPERATION MODE | - |
| POS_DEVICE CLASS | FC |
| POS_MAX_SLEEP_TIME | - |
| POS_MAX_RUN_TIME | - |
| POS_MEASUREMENT_RATE | - |
| POS_ACCEL_THRESHOLD | - |
| POS_BATT | - |
| DATA_ QOS | 0 (Normal) |
| COMMAND_ QOS | 0 (Normal) |
| ADV_EN | 0 (disable) |
| ADV_DATA_SEL | 1 (fixed data) |
| FIXED_ADV_DATA_SEL | 0 (Device name) |
| ADV_INT | 0x0a (1 second) |
| SEN_MSR_INT | 0x06 (60 seconds) |
| SEN_CONFIG | 0x1F (enable all sensors) |
| SEN_SERVICE_ID | 0x01 |
| SEN_PROJECT_ID | 0x01 |
| SEN_COMPANY_ID | 0x0D28 |
| SEN_TXT_OUT_EN | 0x01 |
| SEN_TXT_FORMAT_SEL | 0x00 |
| SEN_BINARY_FORMAT_SEL | 0x00 |
| ALARM_EN | - |
| SEN_CO2_IND_THRE_GREEN | 0x14 |
| SEN_CO2_IND_THRE_RED | 0x28 |
| SEN_CO2_IND_INT | 0x05 |
| custom_bootloader_keys    auth | 69 63 87 5F 9C A5 33 64 37 20 2E 6E 1C B6 31 63 |
| encrypt | 3E 77 0C 4D 13 5B 02 CA 23 A7 22 AE 59 5F 53 3C |

If you turn on the product in Mode 3 as described in 7-1-2, all the settings are reset to the initial value of the firmware settings as shipped from the factory.

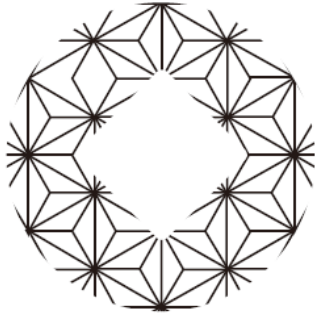Unless otherwise specified, other settings will not be overwritten.

## 9. Mechanical Characteristics

### 9-1. Appearance and Dimensions
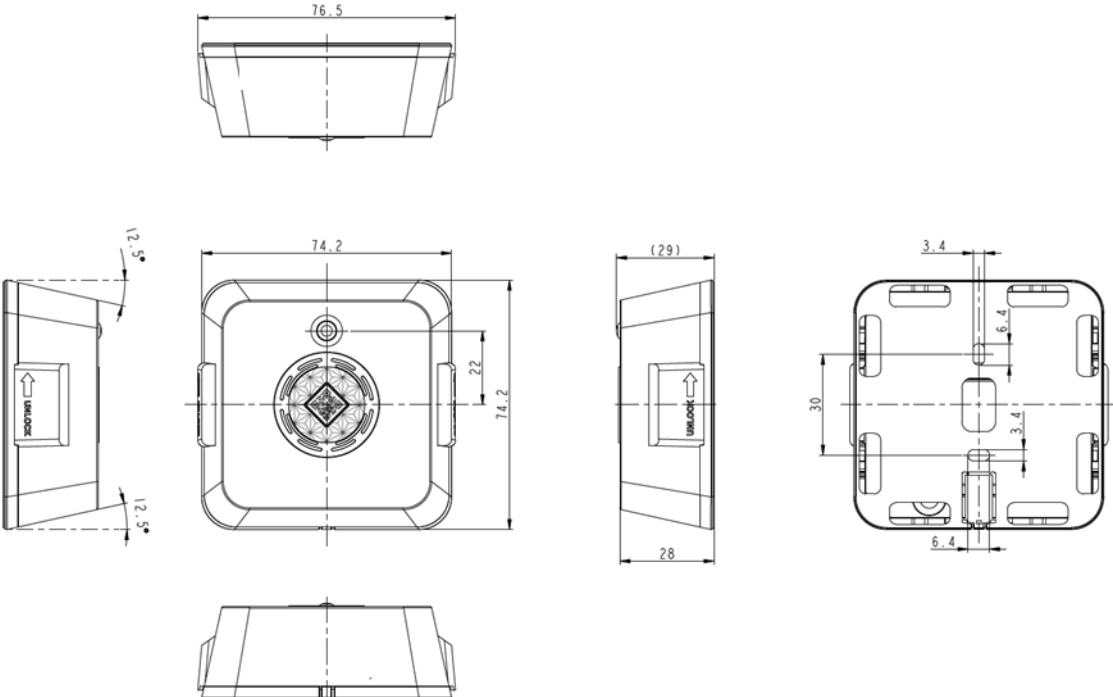


Unit [mm]

9-2. **Graphic and QR code label**



Graphic label
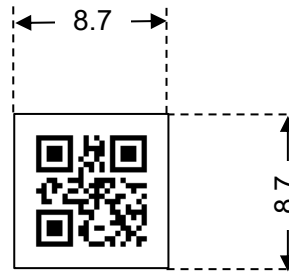


QR code label

QR code label specification

  Dimension: Label size: 8.7 * 8.7 mm

               QR code size: 7.0 * 7.0 mm (Typ)

  Information:

       (1) Node address

Notes

- Please keep clean the QR code label to prevent misreading QR code.

- When wiping off dirt, wipe gently with a soft cloth. Please do not wiping forcefully or using chemical cleaning such as alcohol to prevent damage the QR code label.

9-3. **Label specification**



(1) FCL Identification Number + Identification symbol: FWM8BLZ08 + C

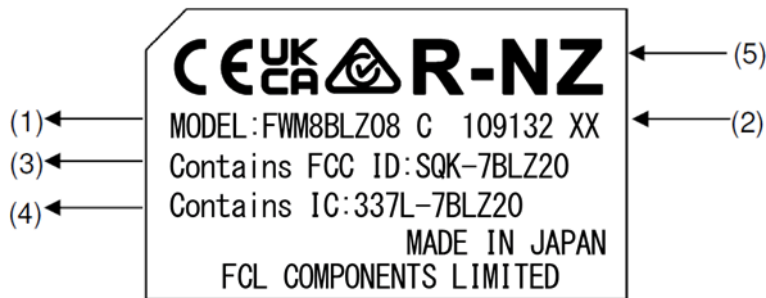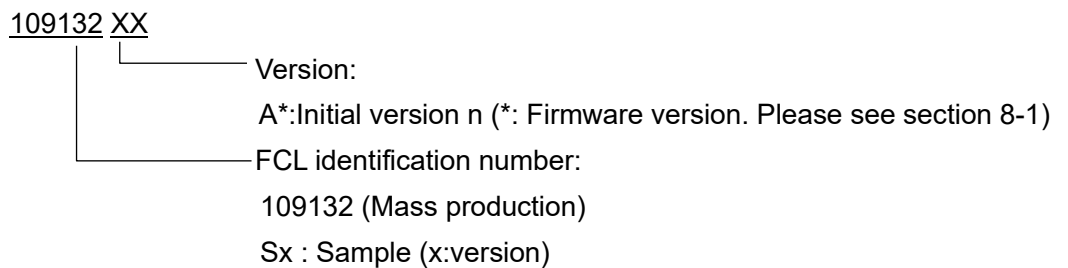(2) Version number, FCL Identification Number

　　109132 XX

　　　　　　　　　　Version:

　　　　　　　　　　A*:Initial version n (*: Firmware version. Please see section 8-1)

　　　　　　　　　FCL identification number:

　　　　　　　　　　109132 (Mass production)

　　　　　　　　　Sx : Sample (x:version)

(3) FCC ID of contained module.

(4) ISED ID of contained module.

(5) Certification logo (CE, UKCA, RCM, R-NZ)

## 10. Storage Conditions

- Do not store this product in the environments exposed to shock or vibration. It may result in damage, malfunction, or deterioration of quality.
- Do not throw or drop cartons containing this product during transportation. It may result in damage, malfunction, or deterioration of quality.

## 11. Warranty period

The warranty period for this product is 18 months after the product is shipped from us.

Note 1: We can not provide any warranty for the operation of this product in all vibrating condition. Please check in your own environment before use.

## 12. Installaltion

### 12-1. **USB powered.**

1. Insert USB type-C cable to the USB connector.
2. Attach the bracket.

USB connector

USB type-C cable
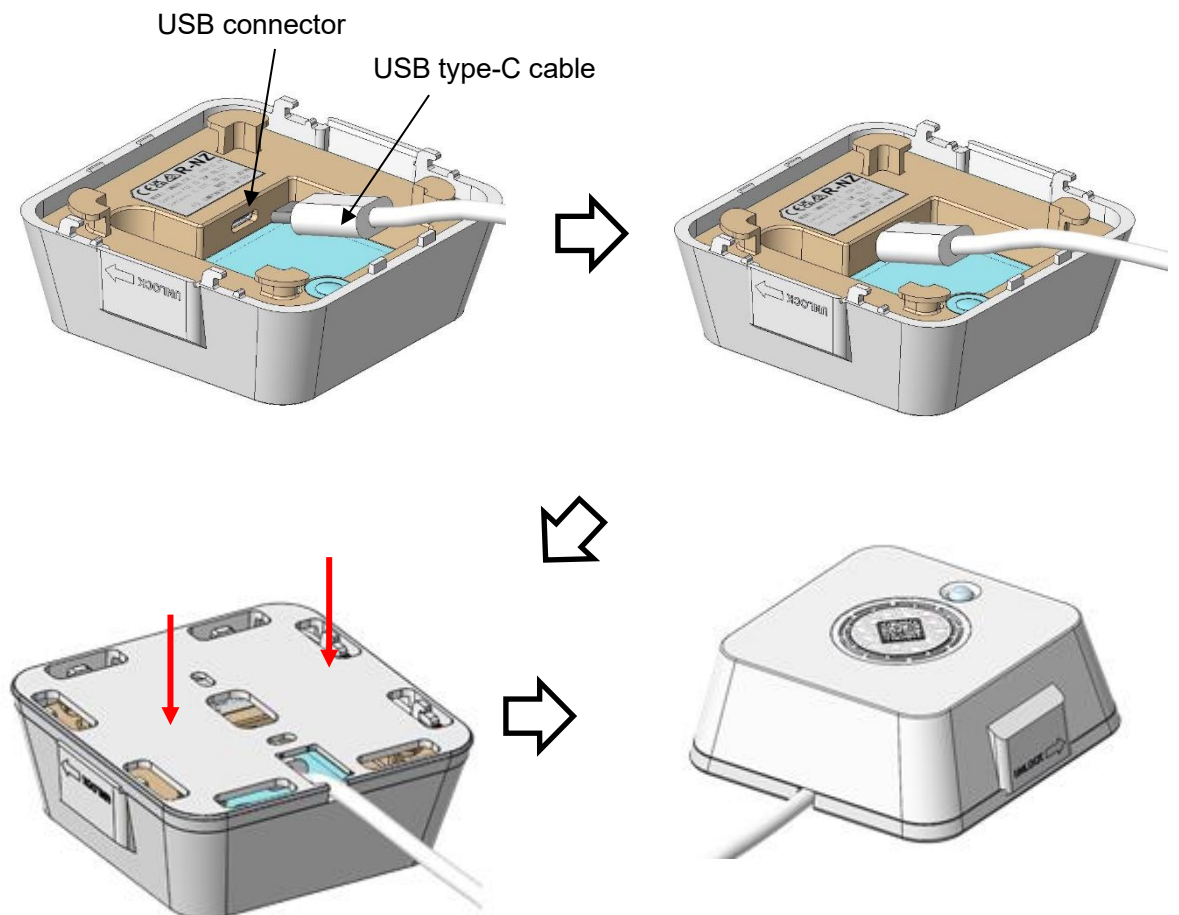
12-2. **USB cable**

Recommended dimension of USB cable is as follows.



USB Cable（TypeC）
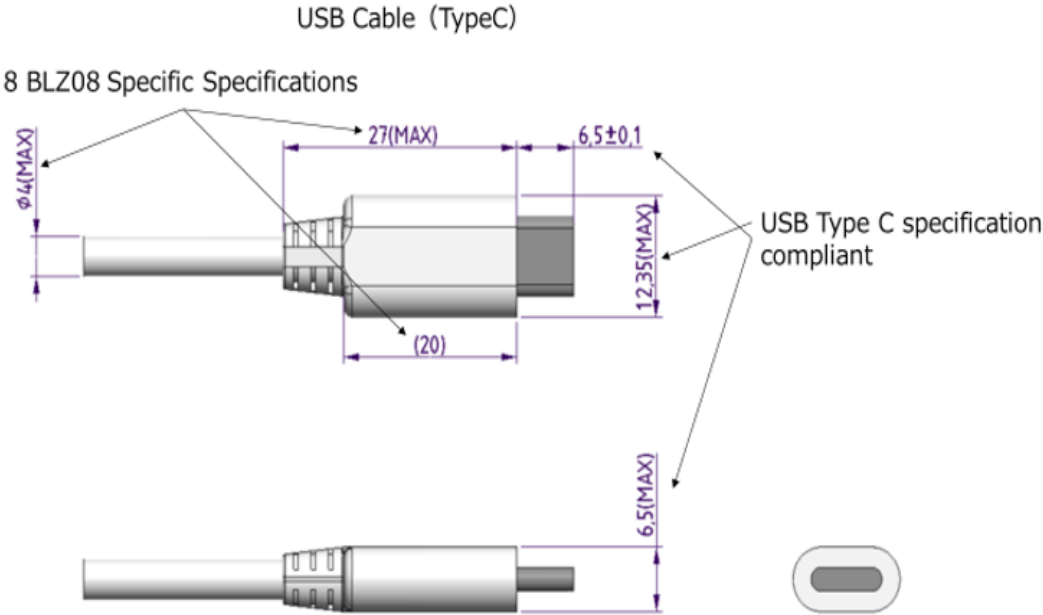
Note

・ Please do not connect the USB cable when the unit and/or USB cable is wet.

## 13. Packing Specification

### 13-1. Label



**Label contents:**

FCL COMPONENTS LIMITED

Customer Part Number
(FWM8BLZO8C-109132) → (P)Customer Part Number: FWM8BLZO8C-109132

BarCode(Code39)

RoHS

G

Vendor Code
(FCL COMPONENTS) → (V)Vendor Code: FCL COMPONENTS

BarCode(Code39)

Pb Pb-free

Lot Code → (IT)Lot Code: **********

BarCode(Code39)

CE → CE Mark
UKCA → UKCA Mark

Quantity → (Q)Quantity: ****        (9D)Date Code: ****  → Date code

BarCode(Code39)        BarCode(Code39)

****
├ Month : 1～12
└ Year : The Last digit of year

Part Number
(FWM8BLZO8C-109132) → (1P)Supplier Part Number: FWM8BLZO8C-109132

BarCode(Code39)

MADE IN JAPAN ← Manufacturing country

13-2. **Shipment Packing**

13-2-1. **Shipping package**



Packing Bag

Inner box

82

82

32

Parting board

Quick guide

Inner box
Max 100pcs

Parting board

Outer box

204

354

441
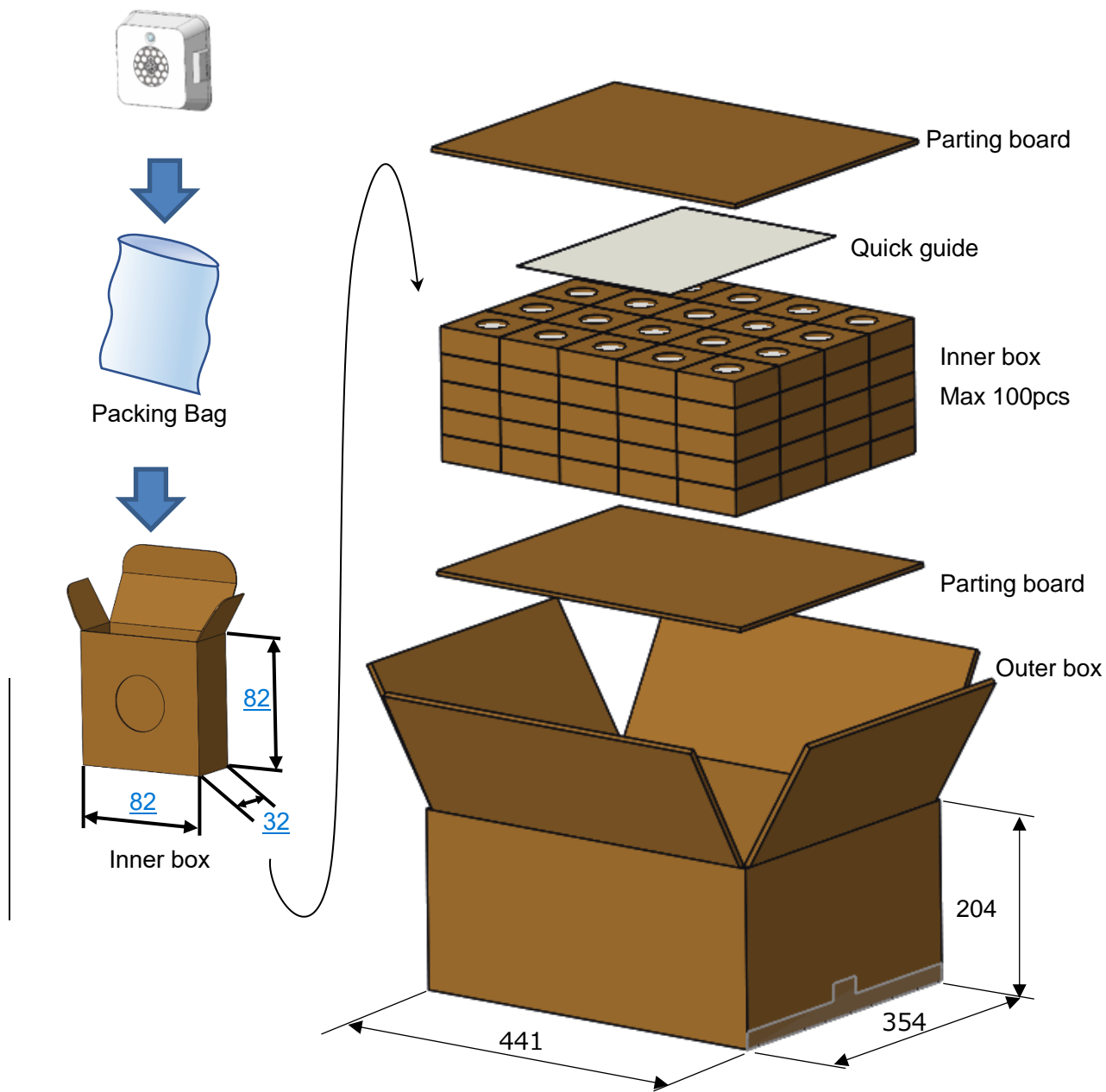
Unit: mm

Note

・ The purpose of the outer box and inner box is used to absorb the impact on the
product during transportation. The boxes may be damaged or deformed due to the
handling during the transportation.

## 14. Caution

- FCL Components Limited ("FCL") may update the firmware without prior notice.
- FCL does not provide the firmware update to the products already delivered to customer.
  If you wish to continuously use the prior version of firmware, please contact your nearest FCL Components's sales office.

## 15. Compliance Statement

**Note to users in the United States of America**

**Caution:**

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

**Declaration of Conformity**

This device complies with part 15 of 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.

**Note to users in the United States of America and Canada**

**Note to users**

It is strictly forbidden to use antenna except designated.

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

This equipment complies with FCC/IC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines and RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment has very low levels of RF energy that is deemed to comply without testing of specific absorption rate (SAR).

**Note to users in Canada**

Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques (RF) CNR-102 de l'IC. Cet équipement émet une énergie RF très faible qui est considérée conforme sans évaluation de l'exposition maximale autorisée.

**Note to users in Canada**

This device complies with Industry Canada's license-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.

**Remarque concermant les utilisateurs au Canada**

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.

**European Community Compliance Statement**
**Note:**

Hereby, FCL Components Limited, declares that this FWM8BLZ08 is in compliance with

the essential requirements and other relevant provisions of Directive 2014/53/EU.

The full text of the declaration of conformity is available at the following internet address:

https://www.fcl-components.com/en/products/wireless-modules/

$C\epsilon$

**Note to users in the Great Britain**
**United Kingdom conformity Assessed Compliance Statement**
**Note:**

Hereby, FCL Components Limited, declares that this FWM8BLZ08 is in compliance with the relevant statutory requirements.

The full text of the declaration of conformity is available at the following internet address:

https://www.fcl-components.com/en/products/wireless-modules/

UK
CA

**Risk assessment:**

As part of the risk assessment on an on-going and periodic basis we will monitor the designated standards list published by the Office for Product Safety and Standard and also the Department for Business, Energy & Industrial Strategy relevant to the Statutory Instrument correct references to radio Equipment for new standards to ensure that the assessment methods are updated as new standards become available. We will also check the ETSI list of published standards for updates to EMC standards pending designation of suitable standards.

## 16. Version History

| Version | Content change | Date |
|---|---|---|
| 1.0 | Initial release | July 1, 2021 |
| 1.1 | '9-3. Label specification' is changed.<br><br>'12-2-3 USB cable' is added<br><br>'13-2. Shipping package' is changed added. | Oct 27, 2021 |
| 1.2 | 2. Features, 9-1 Dimensions are changed.<br><br>3. Applicable standard: UKCA, RCM, R-NZ are added<br><br>5-9-7: CO2 sensor: Accuracy is changed.<br><br>8. Firmware is revised.<br><br>'15. Compliance statement' is added | Jan 18, 2022 |
| 1.3 | 13-1. CE / UKCA marking are added to the label.<br><br>13-2-1. Quick guide is added. | Mar 28, 2022 |
| 2 | Change of Company name | Feb 1, 2024 |