

FCL Components Wireless Modules

Bluetooth® low energy (Bluetooth v5.0) enabled Beacon Unit

FWM8BLZ07-109113 Datasheet

Ver. 2
Feb 1, 2024

The above Product is designed, developed and manufactured as contemplated for general use, including without limitation, general office use, personal use, household use, and ordinary industrial use, but is not designed, developed and manufactured as contemplated (1)for use accompanying fatal risks or dangers that, unless extremely high safety is secured, could lead directly to death, personal injury, severe physical damage or other loss (i.e., nuclear reaction control in nuclear facility, aircraft flight control, air traffic control, mass transport control, medical life support system, missile launch control in weapon system), or (2)for use requiring extremely high reliability (i.e., submersible repeater and artificial satellite), hereinafter referred to as "High Safety Required Use". You shall not use this Product without securing the sufficient safety or reliability required for the High Safety Required Use. If you wish to use this Product for High Safety Required Use, please consult with our sales representatives in charge before such use.

FCL Components Limited

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

1.	Summary	4
2.	Features	4
3.	Applicable Standard	5
4.	Block Diagram	5
5.	Electrical Characteristics	6
5-1.	General Features	6
5-2.	Absolute Maximum Rating	7
5-3.	Recommended Operating Condition.....	7
5-4.	General radio characteristics	7
5-5.	Transmitter Specifications	7
5-6.	Receiver sensitivity.....	7
5-7.	Receiver specifications.....	8
5-8.	Current Consumption Current consumption of radio section.....	8
5-8-1.	Current consumption of radio section	8
6.	Interface specifications	9
6-1.	Software Interface	9
6-2.	Hardware Interface.....	9
7.	Function Specification	10
7-1.	Operation Mode.....	10
7-1-1.	Mode 1 (Normal Operation)	10
7-1-1-1.	Behavior of Mode 1	11
7-1-2.	Mode 2 (Remote Controllable Mode).....	11
7-1-2-1.	Behavior of Mode 2	11
7-1-3.	Mode 3 (Method of Starting on Recovery Mode).....	12
7-1-3-1.	Behavior of Mode 3	12
7-1-4	Function of push button and LED indicator	12
8.	The Firmware initial default setting and factory default setting	13
9.	Mechanical Characteristics	17
9-1.	Appearance and Dimensions	17
9-2.	Stamping label specification.....	17
10.	Storage Conditions	18
11.	Warranty period	18

12.	Mounting / Replacement method of battery	18
12-1.	Use of lithium battery “CR2450”.....	18
12-2.	Removal of the battery cover lid.....	18
12-3.	Inserting the battery.....	19
12-4.	Installation of the battery cover lid.....	19
12-5.	Replacement of the battery.....	20
13.	Packing Specification in shipment	21
13-1.	Reel label.....	21
13-2.	Shipment Packing.....	22
13-2-1.	Tray packing.....	22
13-2-2.	Shipping package.....	24
14.	Compliance Statement	25
15.	Caution about Firmware installed	27
16.	Version History	27

1. Summary

This datasheet applies to the *Bluetooth*[®] low energy (Bluetooth v5.0) enabled Beacon Unit FWM8BLZ07-109113.

2. Features

This product is Beacon Unit compliant with *Bluetooth* Specification Version 5.0, and is possible to communicate in the ISM (Industrial Scientific Medical) band.

This product is powered by a coin cell battery and is equipped with a slide switch, push button, LED indicator.

This product conforms to single mode of *Bluetooth* low energy technology, and mainly operates as broadcaster device and transmits advertising information (Beacon information).

The followings are the key features.

- *Bluetooth* Specification Version 5.0 (*Bluetooth* low energy Single mode) Compliant
- Dimension: 40.0mm x 31.0mm x 12.0mm
- Weight: 9.4g (without CR2450 coin-cell battery)
- Software Interface: FCL Components proprietary commands/events
- Hardware Interface: Push Button, Slide Switch
- Operating Temperature: -30 to +60 °C (without CR2450 coin-cell battery)
- Operating Humidity: 20 to 80 %RH (No dew condensation)
- Power Supply: Coin-cell battery 3V (CR2450)

The functions are as follow:

- Transmission of advertising data (Beacon information)
- Operation mode change by handling a button
- Status display by LED indicator
- Changing of settings from central device (wireless)
- Function to battery monitoring

The *Bluetooth*[®] word mark and logos are registered trademarks owned by *Bluetooth* SIG, Inc. and any use of such marks by FCL COMPONENTS LIMITED is under license.

Other third-party brands and names are the property of their respective owners.

3. Applicable Standard

- *Bluetooth* Specification Version 5.0
QDID: 124430
- FCC, ISED certification
FCC ID: SQK-7BLZ20
IC ID: 337L-7BLZ20
- CE Marking
- ARIB STD-T66
Radio Act (Japan) Certification No. 007-AE0249
(Certificated by the combination of embedded module.)
- RoHS Compliant

4. Block Diagram

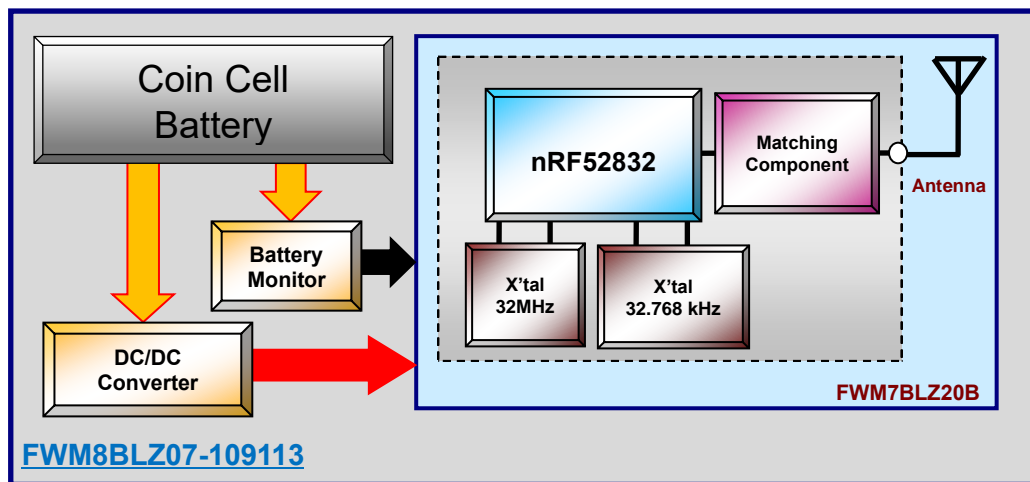


Figure 4-1: Block Diagram

5. Electrical Characteristics

5-1. General Features

Bluetooth Specification Version 5.0 Compliant

Carrier Frequency: 2400 MHz to 2483.5 MHz

Modulation: GFSK

Symbol Rate: 1 Msps, 2 Msps

Data Rate: 1 Mbps, 2 Mbps

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

5-3. Recommended Operating Condition

Items	Symbol	Min	Typ	Max	Unit
Operating Voltage	VDD	2.5	3.0	3.3	V
Operating Temperature	Ta	-30	25	+60	°C
Operating Humidity	Hopr	20	-	80	%RH

*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		±225	±250	±275	kHz

5-5. Transmitter Specifications

Ta=-30°C to 60°C

Items	Condition	Min	Typ	Max	Unit
Output power		-16		+4	dBm
Step size of RF power control			4		dB
RF power control range		+20	+24		dB

5-6. Receiver sensitivity

Ta=-30°C to 60°C

Items	Condition	Min	Typ	Max	Unit
Maximum received signal strength	< 30.8% PER			-10	dBm
Receiver sensitivity	Ideal transmitter < 30.8% PER		-90		dBm
	Dirty transmitter < 30.8% PER		-88		dBm

5-7. Receiver specifications

Ta=25±2°C

Items	Condition	Min	Typ	Max	Unit
RX selectivity	C/I co-channel	-	10	21	dB
	1st ACS, C/I 1 MHz	-	1	15	dB
	2nd ACS, C/I 2 MHz	-	-25	-17	dB
	ACS, C/I (3+n) MHz offset [n = 0, 1, 2, . . .]	-	-51	-27	dB
	Image blocking level	-	-30	-9	dB
	Adjacent channel to image blocking level (±1 MHz)	-	-31	-15	dB
RX intermodulation	IMD performance, 3rd, 4th and 5th offset channel	-50	-39	-	dBm

5-8. Current Consumption Current consumption of radio section

5-8-1. Current consumption of radio section

Ta=25±2°C

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		µA

6. Interface specifications

6-1. Software Interface

Refer to the document of “*Bluetooth* low energy enabled Beacon FDCB s132v6 Firmware Specification”.

6-2. Hardware Interface

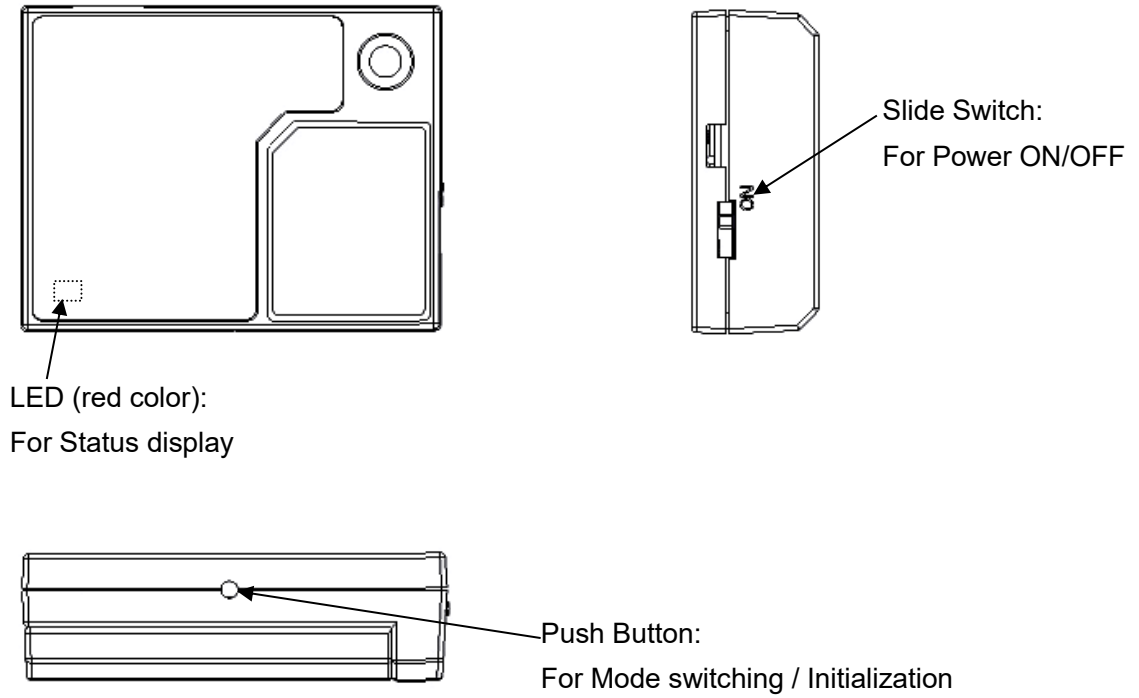


Figure 6-1: Hardware Interface

7. Function Specification

7-1. Operation Mode

This product has two types of operation modes as shown in the table below, and the modes can be switched by operating the slide switch and button at startup. The behavior of MODE_1 and MODE_2 is configurable.

Operation Mode	Description
MODE_1	The mode assumed to be used for normal operation.
MODE_2	The mode assumed to be used for changing settings.
MODE_3 (Recovery Mode)	All configurations are deleted and restored with "Firmware Default Setting".

Each operation setting can be changed.

Setting changes during operation are performed over the air. More specifically, it is possible to change the settings by connecting to the central device equipped with our own commands and issuing commands.

Note: Refer to the document of "*Bluetooth* low energy enabled Beacon FDCB s132v6 Firmware Specification".

7-1-1. Mode 1 (Normal Operation)

Operating Instructions	Slide Switch	Push Button	LED
Turn on this product with a slide switch while not pushing a button.	OFF	OFF	lighting-off
	ON		Blinking (1 second)
			lighting-off

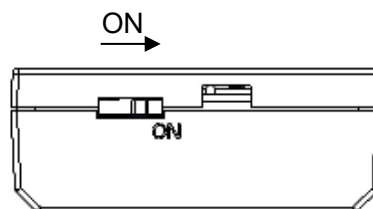


Figure 7-1: Mode 1

7-1-1-1. Behavior of Mode 1

After this product is turned on, LED indicator will blink during 1 second and then it will light off. The behavior of a LED at start-up cannot be changed.

On start-up, this product starts advertising operation by AUTO_BROADCAST function using the setting of WRITE_AB_NV Command.

In this mode, it is not possible to connect with a Central device.

Note: Refer to the document of “Bluetooth low energy enabled Beacon FDCB s132v6 Firmware Specification”.

7-1-2. Mode 2 (Remote Controllable Mode)

Operating Instructions	Slide Switch	Push Button	LED
Turn on this product with a slide switch while pushing a button. Then LED will light up in 1 second.	OFF	ON	lighting-off
	ON		lighting-off (1 second)
Stop pushing a button within 5 seconds, after LED lights up.			lighting-up
		lighting-up (within 5 seconds)	
		OFF	lighting-off

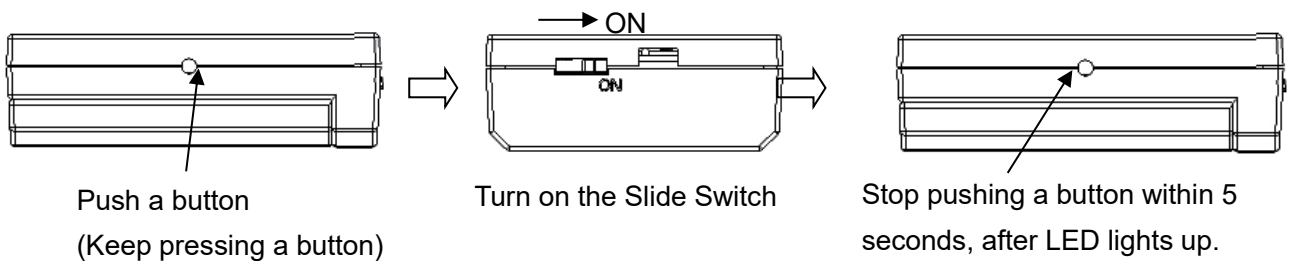


Figure 7-2: Mode 2

7-1-2-1. Behavior of Mode 2

After the startup is completed, advertise with the AUTO_SLAVE function according to the setting of the WRITE_AS_NV command. Operates as a connectable peripheral according to the settings of the first to third parameters of the WRITE_AS_PARAM2_NV command, and advertises data generated by this product. Connection with the central device (including connection in remote command mode) is possible.

Note: Refer to the document of “Bluetooth low energy enabled Beacon FDCB s132v6 Firmware Specification”.

7-1-3. Mode 3 (Method of Starting on Recovery Mode)

Operating Instructions	Slide Switch	Push Button	LED
Turn on this product with a slide switch while pushing a button. Then LED will light up in 1 second.	OFF	ON	lighting-off
	ON		lighting-off (1 second) lighting-up
Continues to push a button more than 15 seconds. Stop pushing a button within 5 seconds, after LED starts blinking. Then all configuration will be initialized and automatically re-boots.			lighting-up (15 seconds)
			Blinking (within 5seconds)
			-
		OFF	

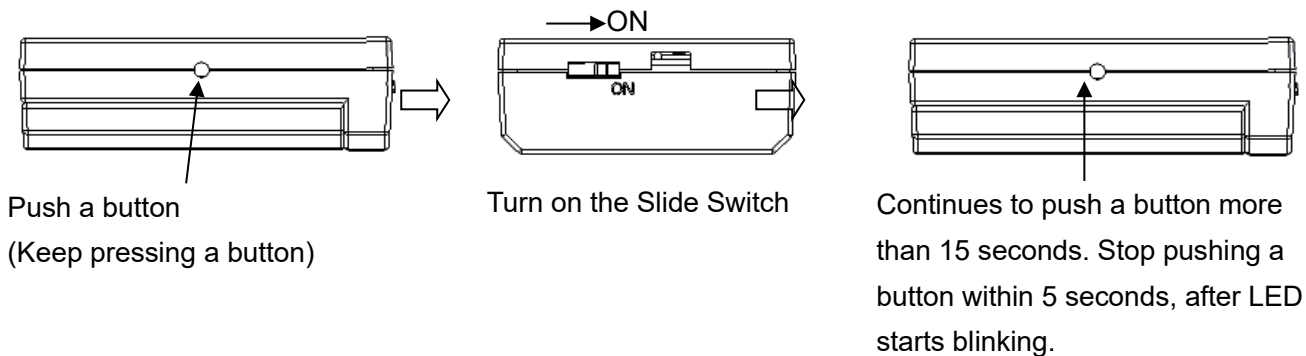


Figure 7-3: Mode 3

7-1-3-1. Behavior of Mode 3

Recovery mode is the function that intend to forcibly recover this product to the default configuration if this product has been uncontrollable by incorrect setting.

Note: All data including advertising data are initialized. Please use this function carefully.

Please refer to section 8.

7-1-4 Function of push button and LED indicator

The push button is used to switch the operation mode (mode 1, mode 2, mode 3: recovery mode) at startup.

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

8. The Firmware initial default setting and factory default setting

This firmware has the initial setting described in the following table.

* All setting can be initialized to this setting by using Mode 3 (Section 7-1-3).

*This product is shipped initializing to firmware initial setting. Unless otherwise stated, any settings are not overwritten as factory default setting.

FW: fdc_b_s132v6-1_v1.00

Command Name	Parameter Name	Value	Explanatory Remarks
WRITE_AS_NV	AS_MODE_1	0 (Disable)	Used the setting by WRITE_AS_PARAM2_NV command.
	AS_MODE_2	2 (Enable)	
WRITE_AS_PARAM1_NV	MODE (1st)	General	*Unused
	INTERVAL (1st)	0x0320	
	TIMEOUT (1st)	0	
	MODE (2nd)	General	
	INTERVAL (2nd)	0x0640	
	TIMEOUT (2nd)	0	
	MODE (3rd)	General	
	INTERVAL (3rd)	0x0c80	
WRITE_AS_PARAM2_NV	MODE (1st)	General	200 milliseconds
	INTERVAL (1st)	0x0140	
	TIMEOUT (1st)	15	
	MODE (2nd)	General	1 second
	INTERVAL (2nd)	0x0640	
	TIMEOUT (2nd)	0	None
	MODE (3rd)	General	*Unused
	INTERVAL (3rd)	0x0c80	
	TIMEOUT (3rd)	0x0000	
WRITE_AB_NV	AUTO_BROADCAST	1	Enabled (Normal Mode)
	ADV_DATA	b_usr_adv	User-specified advertising data is used
	INTERVAL	0x0640	1 second
	TIMEOUT	0	None
WRITE_ADV_DATA_NV	ADV_DATA	0b0946434c20 426561636f6e	Complete local name 「FCL Beacon」 *Unused
WRITE_ADV_DATA_EX_NV (1)	ADV_INDEX	1	The same setting as that by WRITE_ADV_DATA_NV command.
	ADV_DATA	-	

Command Name	Parameter Name	Value	Explanatory Remarks
WRITE_ADV_DATA_EX_NV (2)	ADV_INDEX	2	Note: an example of the secure advertising function applicable format.
	ADV_DATA	18ffea02ffff000 0000011111111 1111111111ea0 2eeeeeeee	
WRITE_ADV_DATA_EX_NV (3)	ADV_INDEX	3	Note: an example of the secure advertising function applicable format.
	ADV_DATA	18ffea02ffff000 0000022222222 22222222222e a02eeeeeeee	
WRITE_ADV_EXT_DATA_NV	ADV_EXT_DATA	eaffea021111111 1111111111111 1111111111111 1111111111111 1111111111111 1111111111111 1111111111111 1111111111111 1111111111111 1111111111111 1111111111111 1111111111111 1111111111111 1111111111111	
WRITE_SR_DATA_NV	SR_DATA	None	
WRITE_SR_DATA_EX_NV (1)	SR_INDEX	1	The same setting as that by WRITE_SR_DATA_NV command.
	SR_DATA	-	
WRITE_SR_DATA_EX_NV (2)	SR_INDEX	2	
	SR_DATA	None	
WRITE_SR_DATA_EX_NV (3)	SR_INDEX	3	
	SR_DATA	None	
WRITE_SEC_PARAM_NV	IO_CAPABILITY	3	No input No output
	MITM_PROTECTION	0	
	BOND	1	
	OOB	0	
WRITE_TX_POWER_NV	TX_POWER	0	
	OFFSET_FOR_ADV	0	
WRITE_NAME_NV	NAME	FWM8BLZ07	
WRITE_APPEARANCE_NV	APPEARANCE	0x0000	
WRITE_PPCP_NV	MIN_INTERVAL	0x0006	7.5 milliseconds
	MAX_INTERVAL	0x0027	48.75 milliseconds
	SLAVE_LATENCY	0x0000	
	SVTO	0x0190	
WRITE_BOOT_MODE_NV	MODE	0	Reserved parameter
	SKIP_CRC_CHECK	0	Reserved parameter
	CLK_CONFIG	5	
	SYS_POWER_CONFIG	1	Enabled
WRITE_REMOTE_CMD_ENABLE_NV	ENABLE_REMOTE_CMD	2	Effective only for MODE_2
WRITE_PW_NV	PASSWORD	None	None
	ENABLE_PROTECT	0	
	ENABLE_FAIL_COUNT	0	

Command Name	Parameter Name	Value	Explanatory Remarks
	ENABLE_RESET	0	
WRITE_ADDR_NV	OVERWRITE_ADDR	0	Not overwrite
	BD_ADDR	000000000000	*Unused
	ADDR_TYPE	0	*Unused
	CYCLE_INTERVAL	0x0384	*Unused
	OVERWRITE_IRK	0	*Unused
	IRK	0x0000000000 000000000000 000000000000 000000000000 000000000000 000000	*Unused
WRITE_SEC_LEVEL_NV	SEC_LEVEL	2	
WRITE_PASSKEY_NV	ENABLE_STATIC_PASSKEY	0 (Disable)	
	STATIC_PASSKEY	000000	*Unused
WRITE_WL_NV	FILTER_POLICY	0	
WRITE_PHY_CONFIG_NV	PHY_CONFIG_ADV	1	
	PHY_CONFIG_FDC	1	
WRITE_BTN_CONFIG_NV	BTN_CONFIG	1	LED blinking
WRITE_SEN_CONFIG_NV	SENSOR_ENABLE	0x0000000f	*Unused
	RESERVE	0x00	*Unused
WRITE_SEN_ADV_FORMAT_SEL_NV	ADV_FORMAT_SELECT	0x11	
WRITE_SEN_MSR_INT_NV	MEASUREMENT_INTERVAL	990	990 milliseconds
WRITE_SEN_FDC_ENABLE_NV	ENABLE_FDC_OUT	1	Enabled
WRITE_SEN_TXT_OUT_ENABLE_NV	ENABLE_TXT_OUT	1	Enabled
WRITE_SEN_ID_INFO_NV	SERVICE_ID	0x0001	
	PROJECT_ID	0x0001	
	COMPANY_ID	0x0D28	
WRITE_SEN_MIC_MSR_NUM_NV	NUMBER_OF_MEASUREMENT	2	*Unused
WRITE_ADV_ROTATE_INTERVAL_NV	ADV_ROTATE_INTERVAL	0x0f	
WRITE_ADV_SEC_CONFIG_NV	OVERWRITE_ADV_SEC_KEY1	0	
	ENC_KEY_SELECT	1	
	MAC_KEY_SELECT	2	
	ENC_BEGIN	0x00	
	ENC_LEN	0x0d	
WRITE_ADV_SEC_KEY1_NV	ADV_SEC_KEY1	0001020304050 60708090a0b0c 0d0e0f	
WRITE_ADV_SEC_KEY2_NV	ADV_SEC_KEY2	1011121314151 61718191a1b1c 1d1e1f	
WRITE_PRIM_ADV_CH_MASK_NV	CH_37	0	
	CH_38	0	
	CH_39	0	
.WRITE_PS_ADDR_FS	BD_ADDR	-	Not overwrite

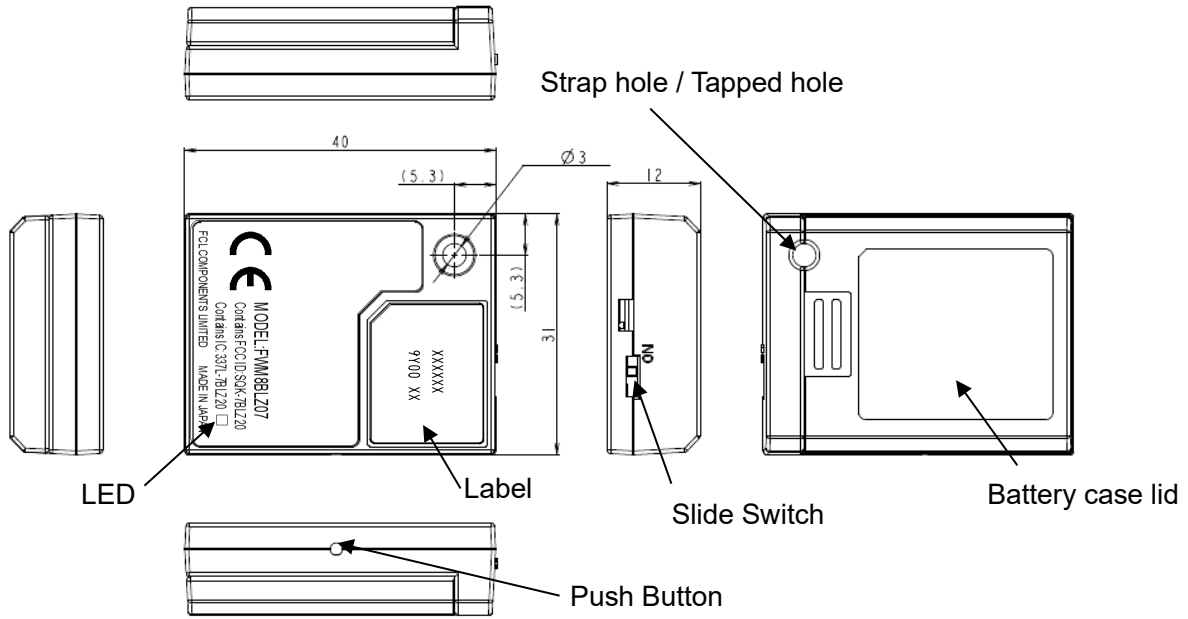
Command Name	Parameter Name	Value	Explanatory Remarks
	ADDR_TYPE	-	

Note: Refer to the document of "*Bluetooth* low energy enabled Beacon FDCB s132v6 Firmware Specification".

Note: These initial settings are subject to change due to firmware revisions.

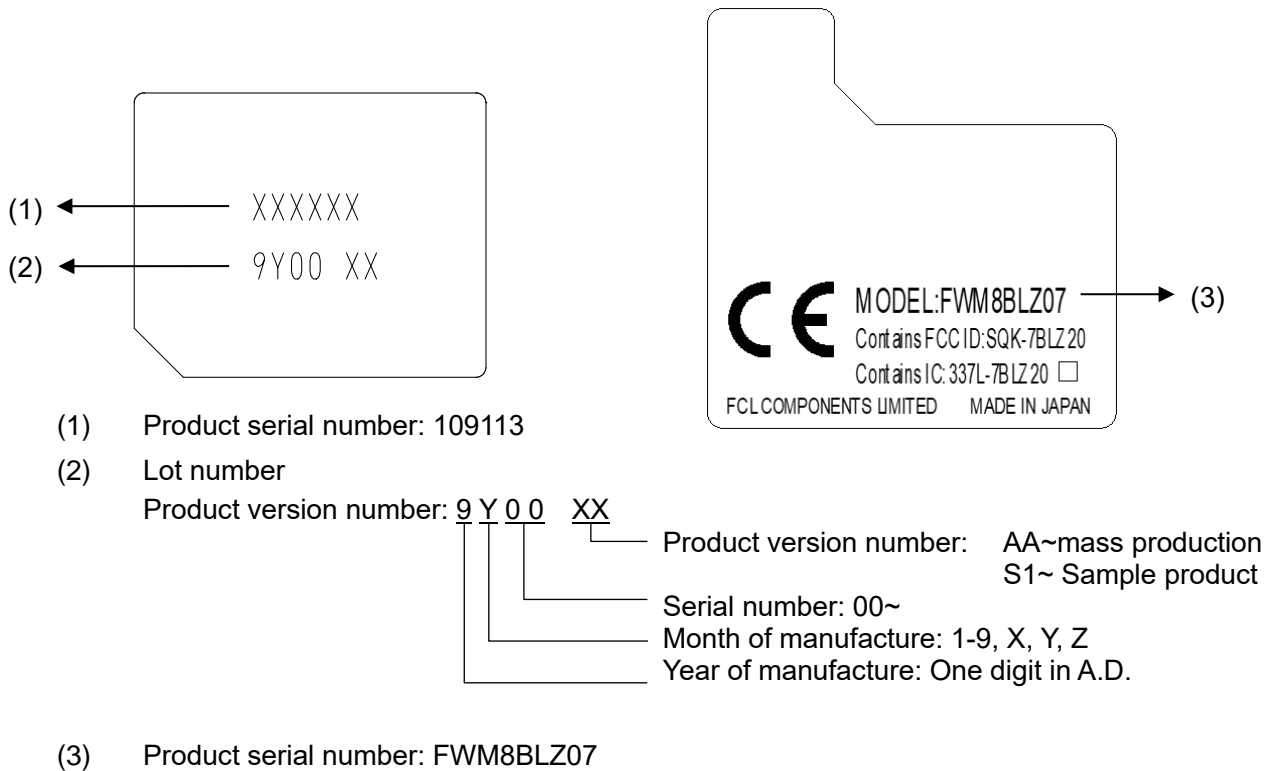
9. Mechanical Characteristics

9-1. Appearance and Dimensions



Unit [mm]

9-2. Stamping label specification



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.

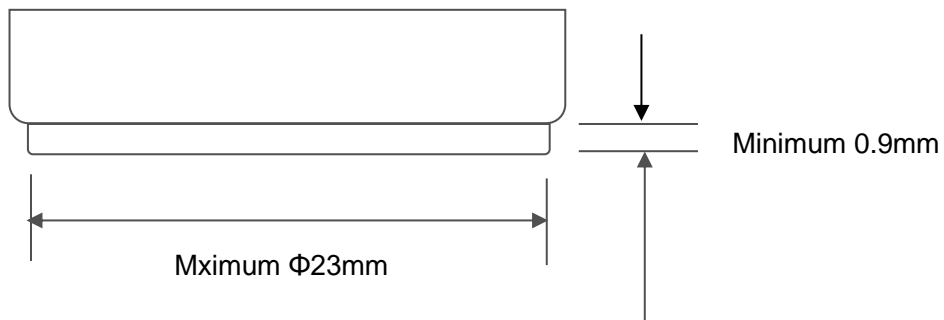
This product has two types of operation modes as shown in the table below, and the modes can be switched by operating the slide switch and button at startup.

12. Mounting / Replacement method of battery

12-1. Use of lithium battery “CR2450”.

Please use a battery with a shape of minus electrode convex part height of 0.9 mm or more and a diameter of ϕ 23 mm or less so that clearance (gap) can be obtained between the holder and the battery.

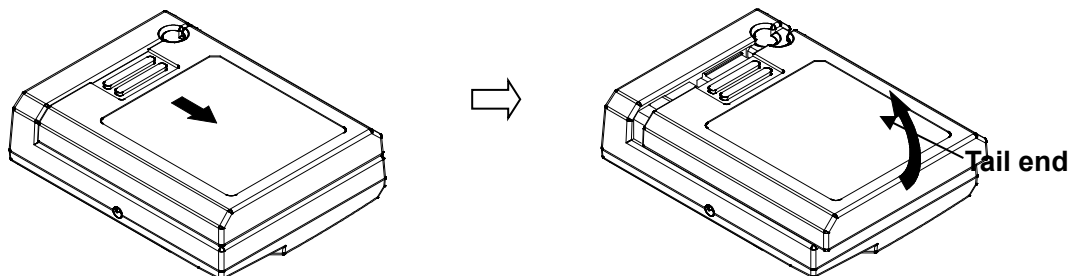
Improper battery shape may damage the beacon holder.



12-2. Removal of the battery cover lid

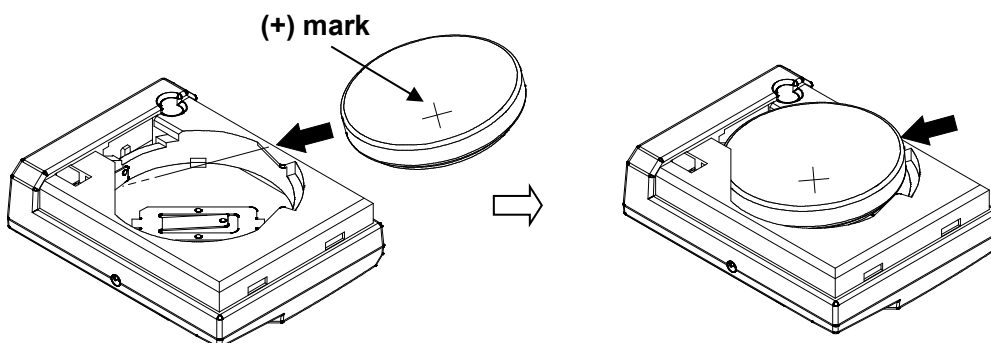
Slide the battery cover lid in the direction of arrowed line, until the cover is unlocked from claws.

Lift the lid from the tail end and remove.

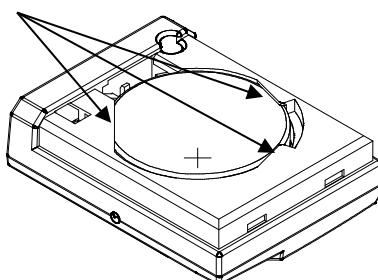


12-3. Inserting the battery

Insert the battery slantingly in the battery compartment with the (+) sign facing up. While inserting the battery, push it gently.



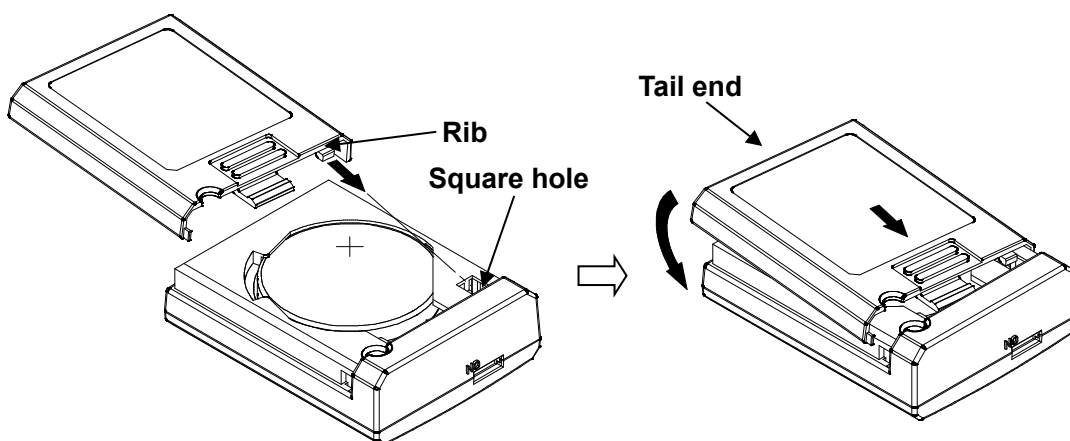
Battery is held by the rib in the battery compartment



The state when battery is mounted

12-4. Installation of the battery cover lid

Insert the pawls of battery cover lid into the square hole of battery compartment slantingly. Parallel the tail end to battery compartment and push the battery cover lid to lock..



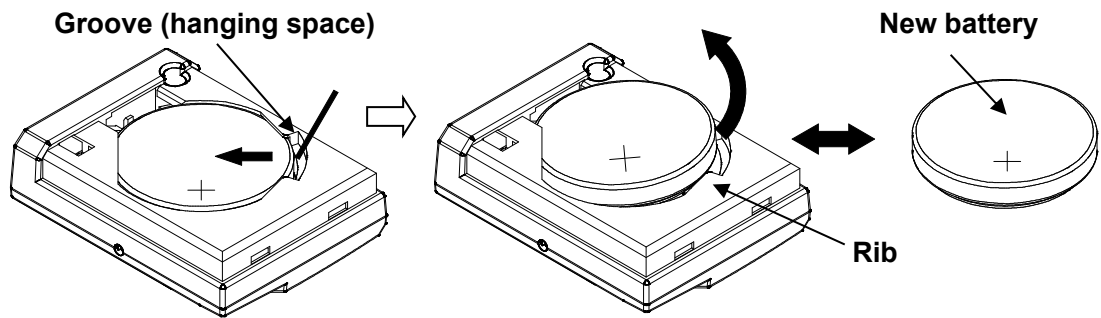
12-5. Replacement of the battery

Remove the battery case lid. (Refer to the section 11-2.)

Push the battery gently from the groove by finger(or object such as toothpick) in the direction of arrowed line.

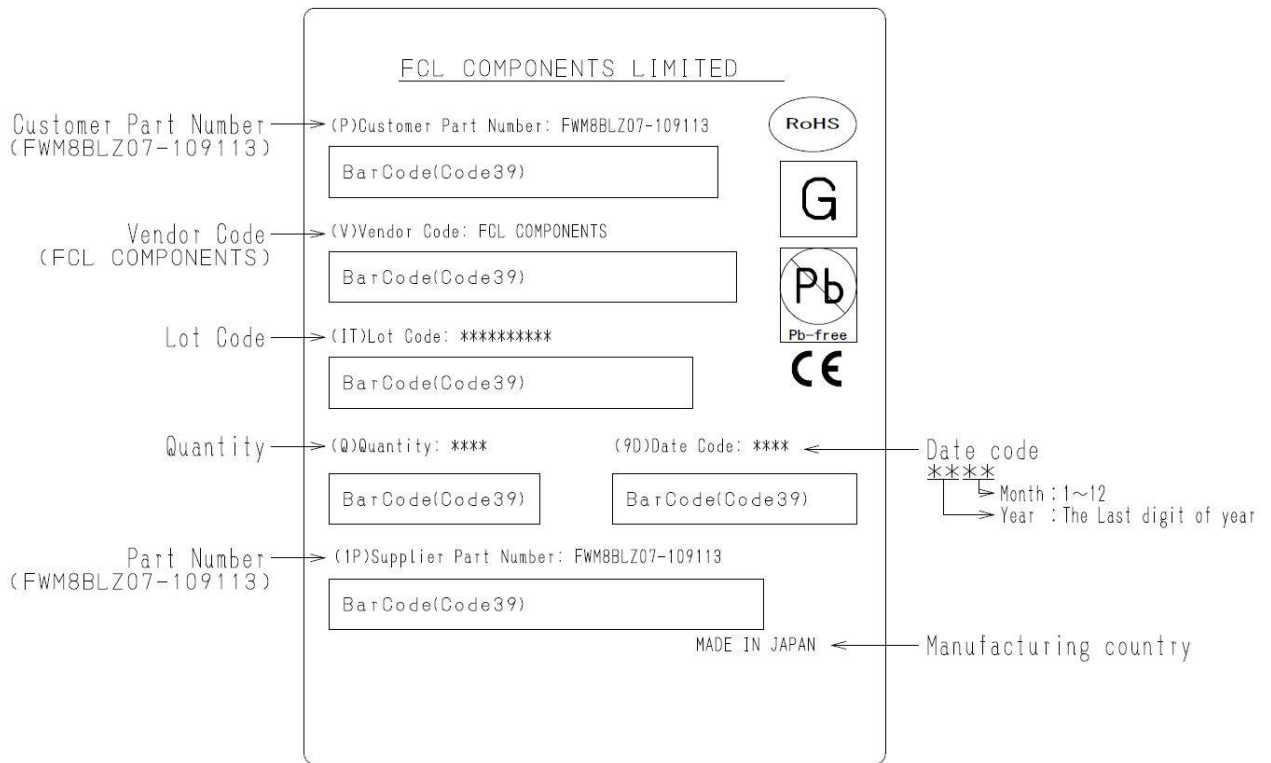
Lift the battery up in the direction of arrowed line, and remove it from the compartment.

Replace with a new battery.



13. Packing Specification in shipment

13-1. Reel label

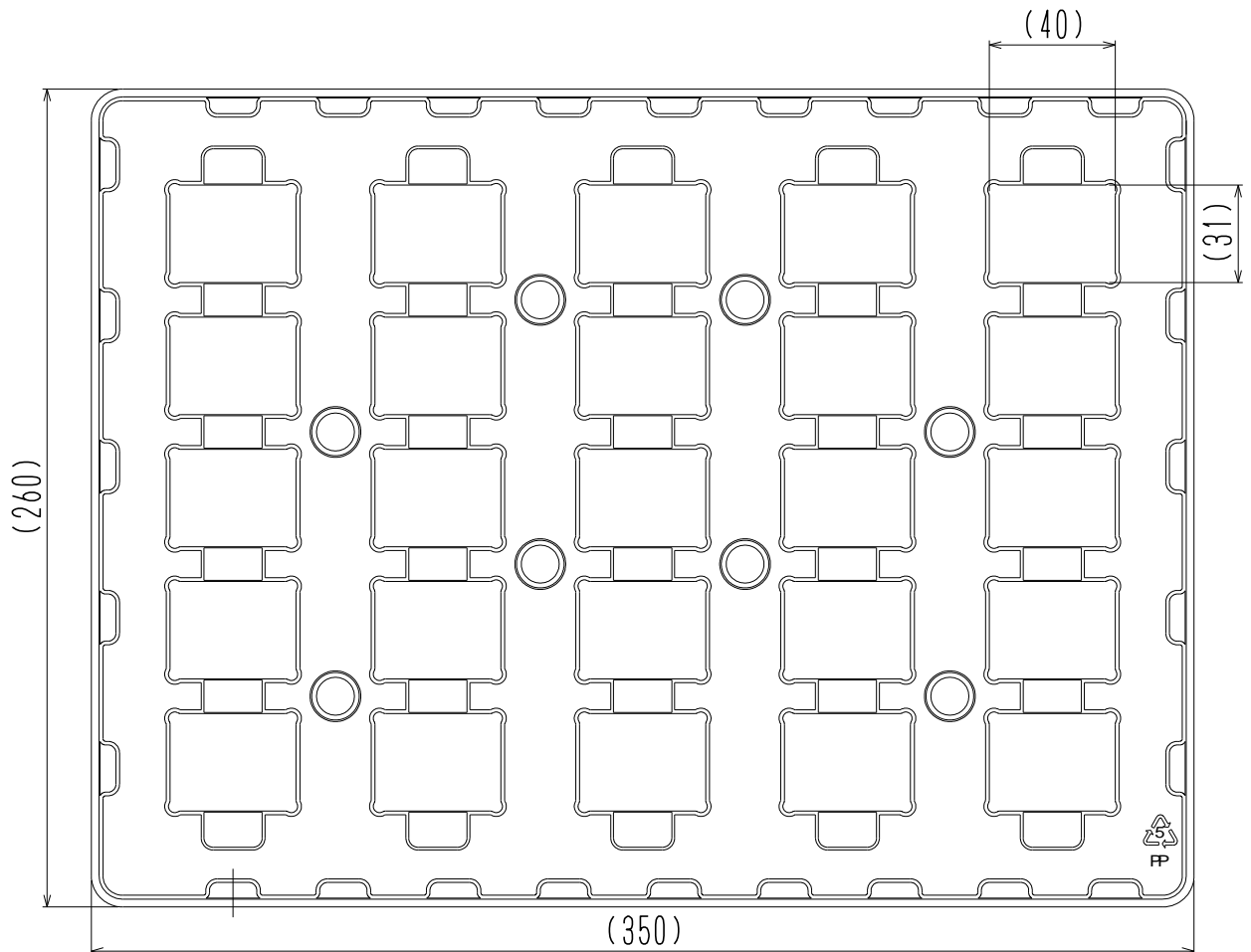


13-2. Shipment Packing

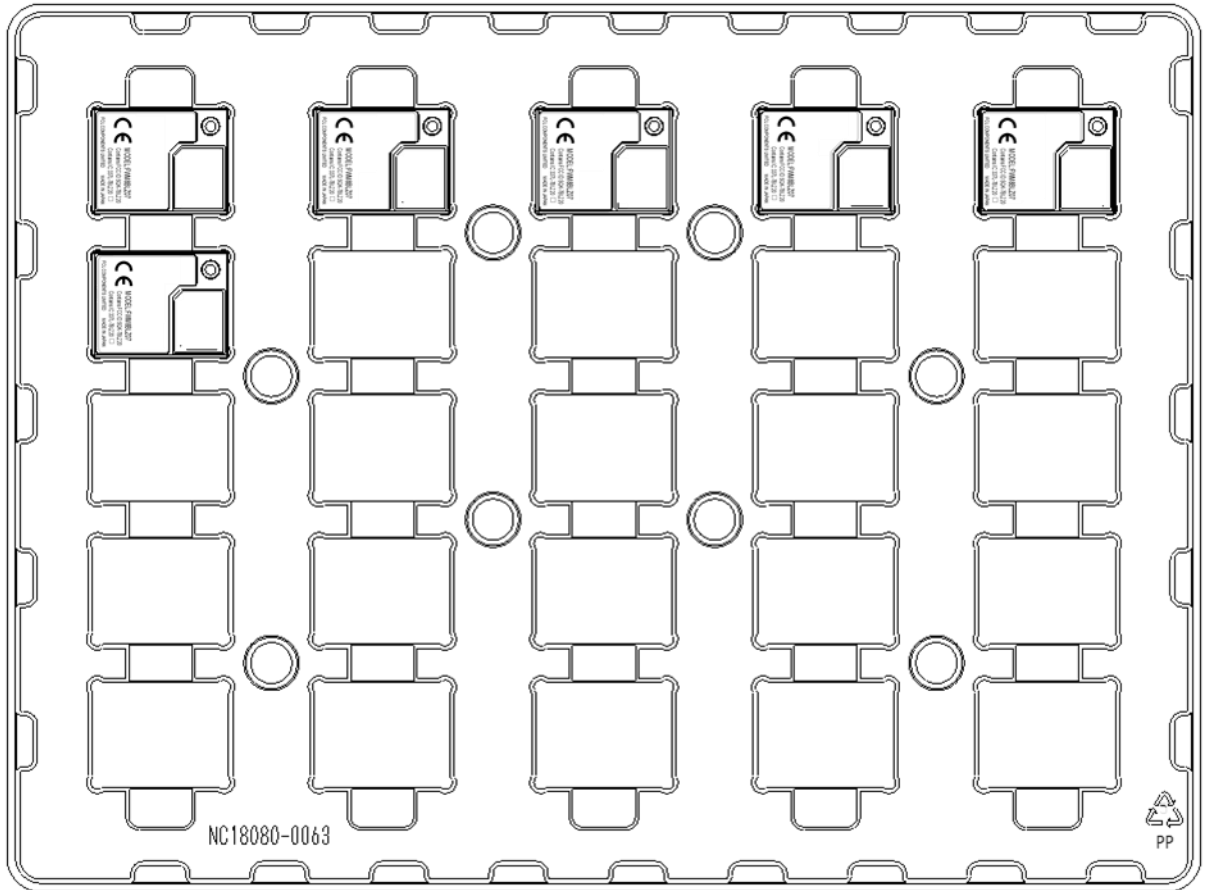
13-2-1. Tray packing

Each tray holds 25 products and packs up to 7 tiers (total 175). Use an empty tray at the top as a lid and converge with tape.

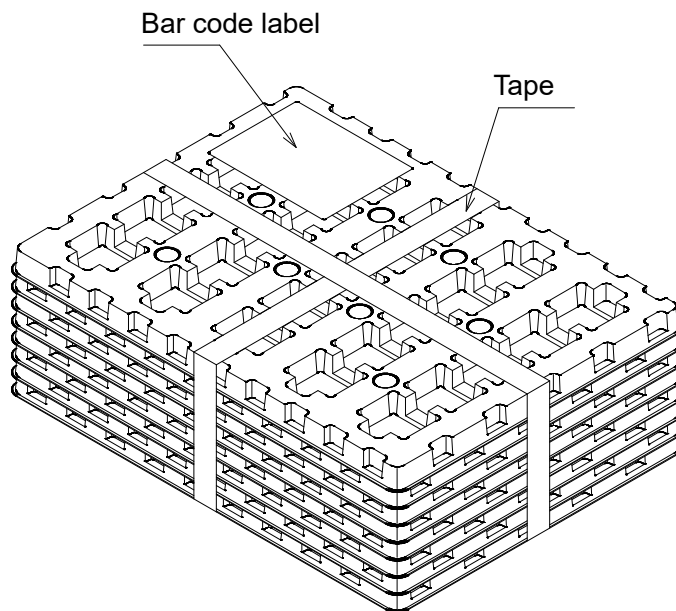
If the product storage tray is less than 7 trays, fill the gap with cushioning material.



Tray dimensions

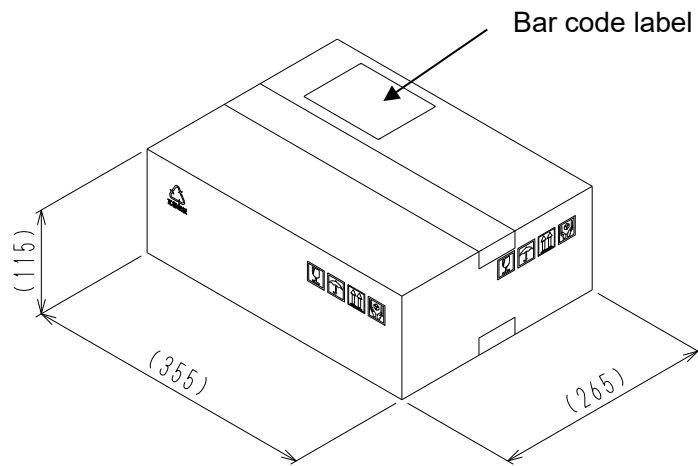
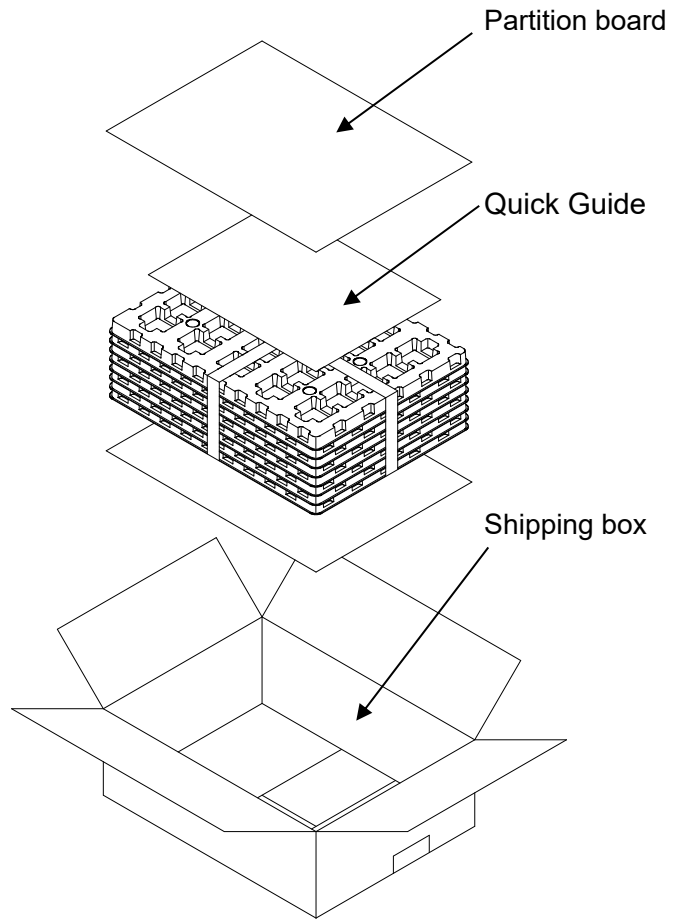


Tray packing



Tray convergence

13-2-2. Shipping package



Shipping box dimensions

14. 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 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.

Remarque concernant 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 FWM8BLZ07 is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.

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

<https://www.fcl-components.com/products/wireless-modules/information/red.html>



15. Caution about Firmware installed

Please note the following regarding firmware updates for this product.

- Firmware updates are performed without notice.
- We do not rewrite firmware for shipped products.
- If you do not agree with the above, please contact us for custom products.

16. Version History

Version	Contents change	Date
0.01	Created first edition.	Jan 10, 2020
0.02	Corrected erroneous descriptions	Apr 16, 2020
0.03	Optimized some descriptions	Jun 9, 2020
1.1	11. Warranty period is added. 13-1. Reel label: CE mark is added. 13-2-2. Quick Guide is added. 14. Compliance Statement is added. Item removed Outer packaging label (previous version 12-2).	May 31, 2022
2	Change of Company name	Feb 1, 2024