Bluetooth® Low-Energy Proximity Beacon

General Description

The **EMBC01** is a Bluetooth Low-Energy proximity beacon suitable for mass deployment by system integrators. The **EMBC01** advertises ID data that is compatible with common beacon standards (UUID, Major ID, and Minor ID). The **EMBC01** is part of the **coin-cell** family of beacons which come in a small, weatherproof enclosure, using a standard coin-cell battery, or as a PCB panel. A push-button with LED feedback can be used to select the right operating mode for your deployment. The EMBC01 operating modes offer tradeoffs between the best performance, range, and battery lifetime.

The push-button can be used to cycle through different beaconing modes. Modes for high performance and long battery life are available. The modes are:

- Sleep Mode with over 7 years of shelf life typical
- ID Short Range Mode offers 100ms beacon interval, 15m range line-of-sight (LOS), and 1.5 months of battery life typical
- ID Medium Range Mode offers 500ms beacon interval, 30m range, and 7.5 months of battery life typical
- ID Long Range Mode offers 1s beacon interval, 75m range, and 12.5 months of battery life typical
- Any mode can be locked for final deployment

The EMBC01 can be delivered in any quantity with guaranteed unique ID numbers. A unique serial number is printed on the label and encoded in a QR code for optical scanning.

Unlike most other beacons on the market today, the EMBC01 can't be wirelessly hacked. The beacons come pre-programmed with a uniquely defined UUID, Major ID, and Minor ID and cannot be re-programmed wirelessly.

The EMBC01 can be customized for individual deployments with the Proximity Beacon Development Kit. The DVK contains a programmer interface board, cable, and 5 proximity beacons for re-programming. The RLink and RLink-Pro programming tools are available separately.

The EMBC01 is FCC, IC, and CE certified, RoHS, Reach, and halogen free compliant.

Features

- **Weatherproof Enclosure**
  - IP-64 rating, -20C to +60C operating range
  - Size: 30mm x 10mm disk; Weight: 7 grams
  - Replaceable CR2032 3V Li battery
  - Integrated push-button with LED indicators
  - PCB-only format also available
- **Accessories**
  - Wall-mount
  - Key-fob
  - Wrist-band
- **Selectable ID Mode beaconing**
  - ID packet format includes:
    - UUID, Major ID, and Minor ID
    - Output power information
  - Short Range: 15m LOS, 100ms beacon interval
  - Medium Range: 30m LOS, 500ms beacon interval
  - Long Range: 75m LOS, 1 second beacon interval
- **Unique Identification**
  - UUID:
    - 699EBC80-E1F3-11E3-9A0F-0CF3EE3BC012
  - Unique Major and Minor IDs (serialized)
  - Unique Serial Number
  - Serial number, Major/Minor ID embedded in QR Code for deployment

"EMBC Finder" Smart Device App

- (Formerly called "emBeacon")
- iOS App available on App Store
  - iPhone® 4S and above
  - iPad® 3 and above (Mini, Air, etc.)
- Android App available on Google Play™
  - 4.3 and newer devices

Applications

- Customer Experience Enhancement
  - Stores, Malls, Airports
  - Museums, Theme Parks, Sports Arenas
  - Conferences, Exhibits, Festivals
- Proximity, Electronic Leash Applications
- Push Notifications, Alerts
- Passive data collection
- Battery, sensor, push-button monitoring using the DVK

Figure 1: The EMBC01 front and back views

Figure 2: The EMBC01 with the wall-mount, key-fob, and wrist-band accessory options

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1. GENERAL DESCRIPTION

The EMBC01 is a 2.4 GHz RF electronic beacon with:
- Proximity capability, compatible with most common beacon standards

The EMBC01 is low-cost and designed for mass-production

The EMBC01 has selectable performance modes:
- 15m typical line-of-site range with 100ms beacon intervals and 1.5 months of battery life
- 30m typical line-of-site range with 500ms beacon intervals and 7.5 months of battery life
- 75m typical line-of-site range with 1s beacon intervals and 12.5 months of battery life

The EMBC01 achieves a long battery life:
- Replaceable CR2032 Li 3V battery
- 7 years storage life

The EMBC01 is small and lightweight:
- 30mm diameter x 10mm disk
- 7 grams

The EMBC01 includes:
- A white plastic enclosure
- A push button for mode changes
- A green and red LED for user feedback
- A permanent label with a unique serial number and QR Code

The EMBC01 is usable over most normal operating conditions:
- -20 to +60 C
- Weather proof (IP-64 rating)

The EMBC01 is certified:
- Environmental: RoHS, REACH, Halogen Free
- RF: FCC, IC, CE

The EMBC01 is compatible:
- With Bluetooth Smart Ready Devices
- With most common beacon standards

The EMBC01 has optional accessories:
- Wall-mount
- Key-fob
- Wrist-band

The EMBC01 is customizable:
- Development kit available
- Adjustable parameters (packet type and contents, UIDs, beacon interval, power level)
- Modifiable firmware
- Added sensors (requires PCB and firmware modifications using the DVK)
- Added RFID tag (NFC, UHF, etc.)

The EMBC01 comes with EMBC Finder, a free smart phone and tablet application for:
- iOS (iPhone 4S and above, iPad 3 and above)
- Android (4.3 and newer devices)

2. OPERATING AND STORAGE CONDITIONS

The operating and storage conditions are listed in Table 1.

Table 1: Operating and storage conditions

Module operating temperature and humidity range	-20°C to 60°C and 0 to 90% RH
Weatherproof	Module can be used in outdoor conditions. It is rated IP64 according to CEI 60529.
Module storage temperature and humidity range	Modules must be stored in original EM packing at Temp=25°C±10°C / RH≤70%.

3. PRODUCT OUTLINE DIMENSIONS

3.1. EMBC01 FINISHED PRODUCT

The EMBC01 finished product outline dimensions are shown in Figure 3.
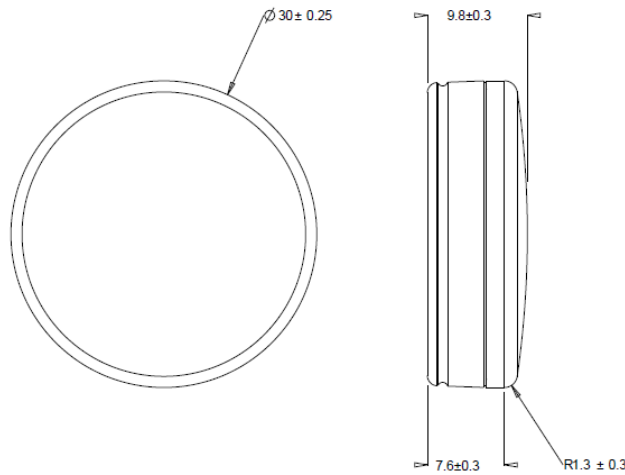
Figure 3: EMBC01 finished product outline dimensions

3.2. EMBC01 PCB PANEL

The EMBC01 is also available in PCB panel format. The PCB panel dimensions are shown in Figure 4. Single board dimension after separation from panel is Ø26mm.
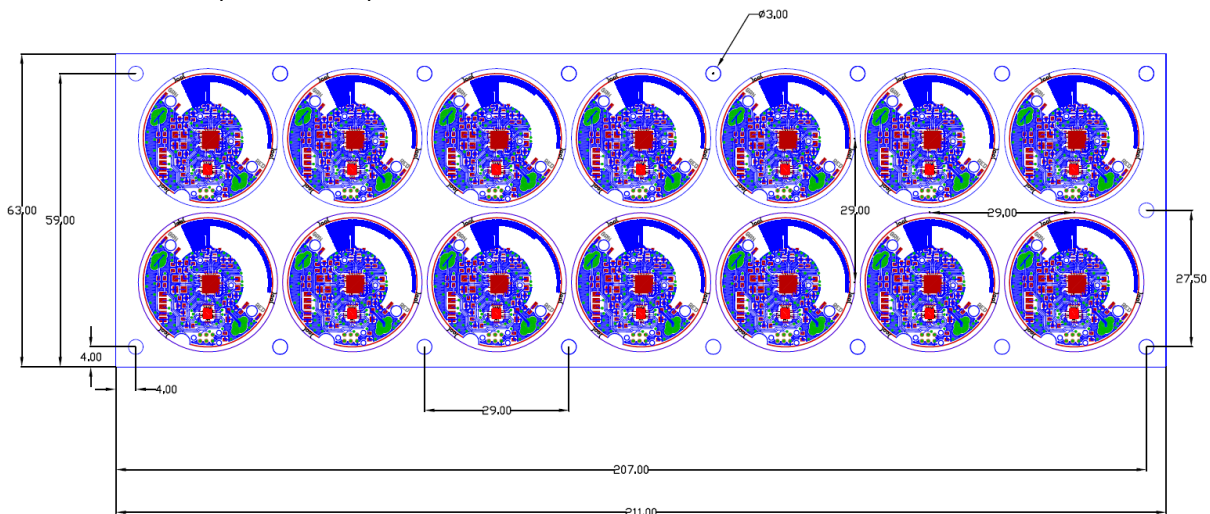
Figure 4: EMBC01 PCB Panel dimensions

The EMBC01 PCB panel is completely populated, and tested. Firmware is loaded and beacons are serialized with unique identification numbers. The good PCBs are marked with ink on the component side of the board. The PCB panel comes without battery holder, battery, or dome switch. Housings and labels are not provided.

4. MECHANICAL

4.1. PUSH BUTTON

The push button is activated with a firm press. It is designed so that it cannot be activated accidentally.

The push button is capable of short (<2 sec) and long (>2 sec) presses. Short presses are used to change modes. A long press is used to lock the present mode.

4.2. LED

The green and red LEDs are visible through the plastic enclosure under indoor lighting conditions. LEDs are used to indicate the operating mode of the beacon.

5. ELECTRICAL

Typical values are generally stated at room temperature (T=25°C) with a supply voltage of VCC=3.0V.

5.1. HANDLING PROCEDURES AND ABSOLUTE MAXIMUM RATINGS

This device has built-in protection against high static voltages or electric fields; however, anti-static precautions must be taken as with any CMOS components. Unless otherwise specified, proper operation can only occur when all terminal voltages are kept within the specified voltage range. The absolute maximum ratings of the EMBC01 are listed in

Table 2.

Table 2: Absolute maximum ratings

Parameter	Min	Max	Unit
Supply Voltage VCC - VSS	-0.3	3.8	V

Stresses above these listed maximum ratings may cause permanent damage to the device. Exposure beyond specified operating conditions may affect device reliability or cause malfunction

5.2. GENERAL OPERATING CONDITIONS

The general operating conditions of the EMBC01 are listed in Table 3.

Table 3: General Operating Conditions

Parameter	Min	Typ	Max	Unit
Supply voltage	2.0	3.0	3.6	V
Temperature range	-20		+60	°C

5.3. ELECTRICAL CHARACTERISTICS

The electrical characteristics of the EMBC01 are given in Table 4. Typical specification is at room temperature (25°C).

Table 4: Battery Life-Time and Range

Operating Mode	Specification	Min	Typ	Max	Unit
Sleep Mode	Battery Lifetime		7		years
	Average Current		0.6		μA
ID Short Range Mode	Battery Lifetime		1.6		months
	Beacon Interval		100		msec
	EM9301 Power Level 1		-14		dBm
	Average Current		192.2		μA
	Distance (range)		15		m
ID Medium Range Mode	Battery Lifetime		7.5		months
	Beacon Interval		500		msec
	EM9301 Power Level 3		-8		dBm
	Average Current		41.1		μA
	Distance (range)		30		m

Operating Mode	Specification	Min	Typ	Max	Unit
Long Range Mode	Battery Lifetime		12.4		months
	Beacon Interval		1000		msec
	EM9301 Power Level 5		0		dBm
	Average Current		24.8		µA
	Range		75		m

Note 1: Battery Lifetime is calculated based on the average current using a Renata CR2032 battery with 225mAh of battery life under typical conditions.
Note 2: Beacon interval is the Bluetooth advertising interval (advInterval) as defined in the Bluetooth Specification V4.0, Volume 6, Part B, Section 4.4.2.2.
Note 3: Range is measured outdoors, line-of-sight, with an iPhone 4S and iPad.

5.4. REGULATORY

The EMBC01 complies with the following regulatory requirements:

5.4.1. USA-FCC
- Part 15 – General emissions
- Part 15.247:2011 – Operation within the band 2.4-2.4835GHz
- Parts 15.205 and 15.209 – Spurious emissions

5.4.2. Canada-IC
- ICES-003 – General emissions
- RSS-210:2010 – Low-power License exempt Radio Communication Devices

5.4.3. CE
EM Microelectronic, as the responsible party for regulatory compliance, declares under our sole responsibility that as delivered the described product is in conformity with the R&TTE Directive 1999/5/EC1, Commission Regulation (EC) No 1275/2008 and 278/2009, following the provisions of ERP Directive 2009/125/EC, EU RoHS Directive 2011/65/EU and carries the CE-marking.

5.4.3.1. SAFETY File

1. Information on all plastics (flame rating and UL listing) model numbers
2. Battery: Specification, UL listing, and reports from vendor (Standards are UL 1642 and IEC/EN 62133)
3. PCB Board (same info as plastics)
4. Label (same info as plastics)

5.4.4. Australia/New Zealand
- AS/NZS CISPR 22:2009+A1:2010 (tested only, but not filed)

6. FIRMWARE

The following is a basic description of the EMBC01 firmware functionality.

6.1. STATE MACHINE

The state-diagram for the EMBC01-F401 is shown in Figure 5. The firmware implements the following modes:
- Self-test
- Sleep-mode
- ID Short Range Mode
- ID Medium Range Mode
- ID Long Range Mode
- Lock Mode

Upon insertion of the battery, a self-test is performed, and the EMBC01 then enters a low-power sleep mode. On subsequent short button presses (less than 2 seconds), the green LED flashes once and iterates through ID Short Range Mode, ID Medium Range Mode, and ID Long Range Mode. On the next short button press, the red LED flashes once and then the EMBC01 enters the low power sleep mode again. Subsequent short presses iterates through these four modes again. In any state, if a long button press is performed (longer than 2 seconds), the green LED will flash twice and the EMBC01 will stay in that mode until the end of battery life.
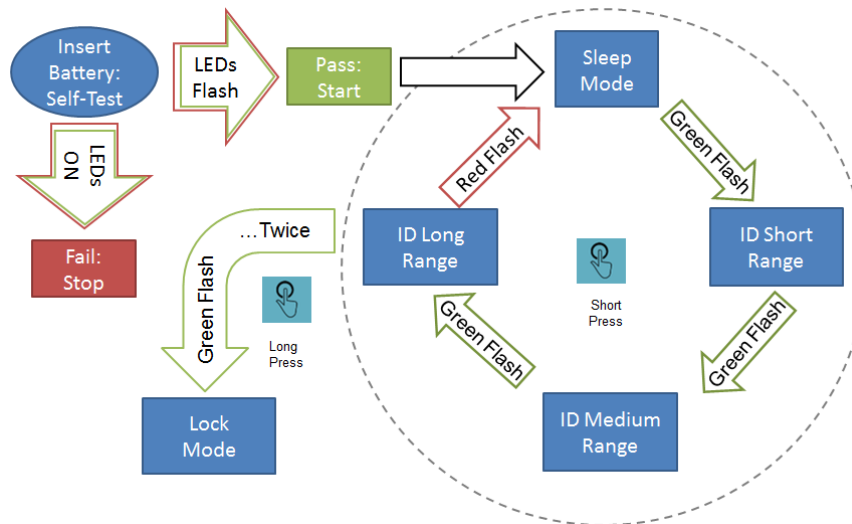
Figure 5: EMBC01 State-Diagram

6.1.1. Self-Test

The self-test function tests the following functions:
- Perform and verify a system reset
- Verify battery voltage
- Verify proper version and operation of the EM9301
- Perform calibration of the EM9301 and verify calibration results
- Transmit 10 advertising packets of Sensor Data and ID data. (Sensor Data packet formats are defined in a separate document.)

If the test passes, both LEDs will flash. If the test fails, both LEDs will turn on and remain on.

6.2. PACKET CONTENTS

The Bluetooth advertising packets are non-connectable, undirected advertising events (ADV_NONCONN_IND) which follow the GAP specification according to the Bluetooth Specification V4.0, Volume 3, Part C, Section 11.

Packets follow the definitions defined in the *EMBC Beacon Packet Specification* in the ID Data section.

6.2.1. Device Address

The first 3 octets of the device address are the EM Microelectronic OUI assigned address from the IEEE 802 committee: 0x0CF3EE.

The last 3 octets of the device address are uniquely assigned by EM Microelectronic.

6.2.2. ID Data Packet Format

The ID data packet format is described in the following specification: Proximity Beacon Specification Release R1 Draft D1, which can be obtained from Apple, Inc.

6.2.2.1. ID Data ID numbers

The following ID numbers are used:
- The UUID is: 699EBC80-E1F3-11E3-9A0F-0CF3EE3BC012
- The Major ID is a 16-bit unsigned non-zero value uniquely assigned by EM Microelectronic.
- The Minor ID is a 16-bit unsigned non-zero value uniquely assigned by EM Microelectronic.

6.2.2.2. ID Data Measured Power

Measured power as described in Proximity Beacon Specification Release R1 Draft D1 with iPhone 5S.

7. LABEL

The label has the following contents:
- Model: EMBC01
- Unique Serial Number
- FCC-ID: 2ACQR-EMBC01
- IC ID: 12155A-EMBC01
- FCC and CE Marking
- Major ID/Minor ID
- EM Microelectronic company name
- QR Code containing the unique Serial Number/Major ID/Minor ID

7.1. SERIAL NUMBER

The serial number is generated by reading the device address of the EMBC01, reversing the byte order, and printing the number in decimal form to 15 digits. For example:
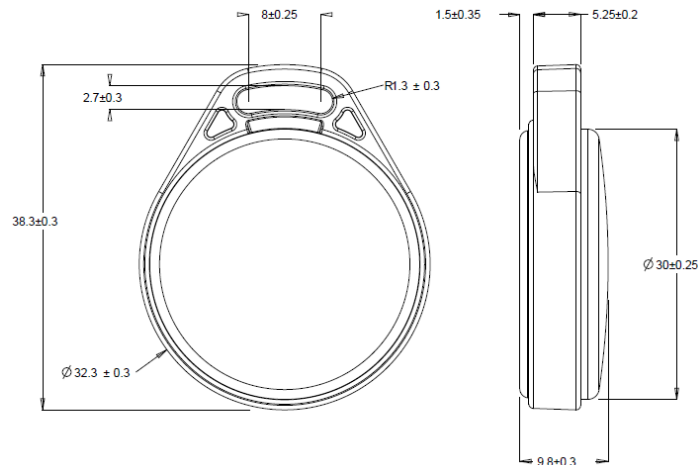- Device Address: 0x0CF3EE5A0001
- Serial Number: 001101037237004

8. ACCESSORIES

Mounting accessories are available as options and deliverable separately.
Snap features allows multiple assembly and disassembly operations.
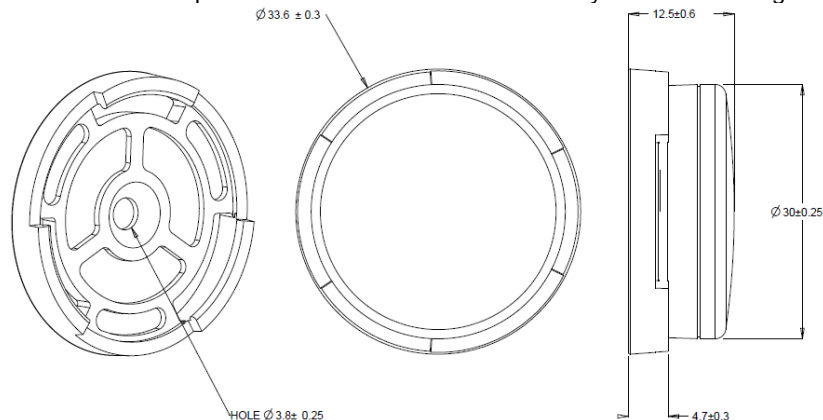
8.1. KEY-FOB

The outline dimensions of the EMBC01 product with the key-fob accessory are shown in Figure 6:

Figure 6: EMBC01 product with key-fob accessory outline dimensions

8.2. WALL-MOUNT

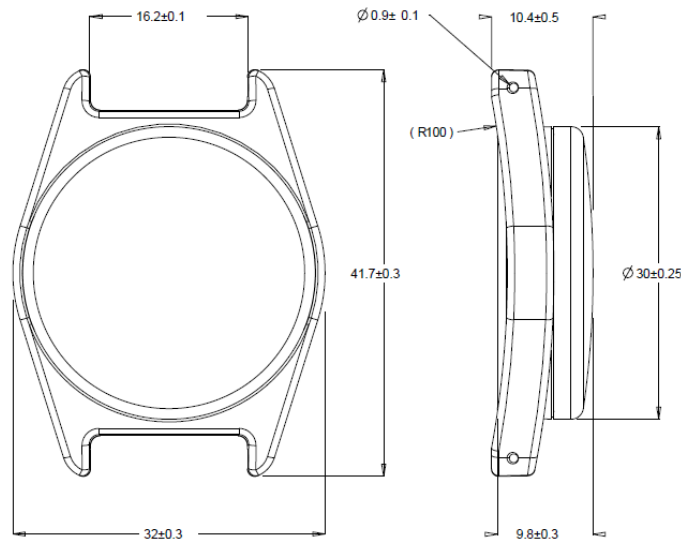The outline dimensions of the EMBC01 product with the wall-mount accessory are shown in Figure 7:

Figure 7: EMBC01 product with wall-mount accessory outline dimensions

8.3. WRIST-BAND

The outline dimensions of the EMBC01 product with the wrist-band accessory are shown in Figure 8:

Figure 8: EMBC01 product with wrist-band accessory outline dimensions

9. RELIABILITY

9.1. PRODUCT RELIABILITY

The EMBC01 complies with reliability tests listed in Table 5.

Table 5: EMBC01 reliability tests

Test	Conditions	Acceptance criteria
High temperature and humidity test (TH)	85°C / 85%RH for 500h	Functional Test is Pass
High temperature storage (HTB)	70 ± 2°C for 500h	Functional Test is Pass
Low temperature storage (LTB)	-20 ± 2°C for 500h	Functional Test is Pass
Thermal cycling (TC)	From -20°C (15 min) to +65°C (15 min) for 100 cycles. Transfer time ≤ 5 minutes	Functional Test is Pass

9.2. PACKING RELIABILITY

The packing complies with the reliability tests listed in Table 6.

Table 6: Packing reliability tests

Test	Conditions	Acceptance criteria
Drop test with modules	Drop the outer box from 0.8m on concrete: - 6 sides - 8 corners	Modules Visual Inspection and Functional Test are Pass

10. PACKING AND LABELING

10.1. EMBC01 FINISHED PRODUCT

10.1.1. Inner Packing

The EMBC01 beacons are packed in custom antistatic trays.

- Only one tray per box can have parts from 2 different product lots.
- Tray size is 300 x 261 x 38 mm.
- Number of parts per tray is 100pcs.
- There are 5 trays per stack, excluding cover tray.

A label is applied on each stack. The minimum information on the label is specified in Figure 9.

EM P/N:

Mfg date:

Module Lot Nr:

Qty:

Figure 9: EMBC01 packing label information

10.1.2. External Packing

Tray stacks are packed in cardboard box.

- Quantity of parts per box is 1000 pcs (2 tray stacks).
- Box dimensions are 37 x 55 x 43 cm.

A label is applied on each box. The minimum information on the label is specified in Figure 10.

EM P/N:

Mfg date:

Module Lot Nr:

Qty:

Weight:

Figure 10: Panel packing label information

10.2. EMBC01 PCB PANELS

10.2.1. Inner Packing

The EMBC01 PCB panels are packed in suitable anti-static material.

10.2.2. External Packing

The EMBC01 are packaged in suitable external packaging.

11. THE EMBC01 BEACONS ARE ENVIRONMENTALLY SAFETY

The EMBC01 is:

- RoHS compliant according to EU Directive 2011/65/EU.
- Halogen Free according to IEC 61249-2-21:2003.
- REACH compliant according to EU Regulation 1907/2006

12. ORDERING INFORMATION

The EMBC01 is available as a finished product in a plastic housing with full FCC, IC, and CE certification. It is also available in PCB form as a panel which requires country certification (ie FCC, CE, etc.) of final product performed by the customer. The EMBC01 wall-mount, key-fob, and wrist-band accessories are available separately. Pre-certification beacons are available for evaluation and development. The Proximity Beacon Development Kit is available with 5 pre-certification beacons, an interface board, and cable to the RLink programmer for custom programming. The RLink and RLink Pro can be ordered separately. The EMBC01 ordering information is shown in Figure 11 and the order numbers are shown in Table 7

EMBC01   -   F401   H1000

Base Part Number

Housing Version:
H1000: no logo
H2000: EM Micro logo
Other: Assigned by EM

Accessory Code:
WMA: Wall-mount accessory
KFA: Key-fob accessory
WBA: Watch-band accessory
DVK: Development kit
EVK: Evaluation kit

Firmware Version:
F401: Proximity Beacon Version
Other: Assigned by EM

Figure 11: EMBC01 Ordering Information

Table 7: EMBC01 Related Order Numbers

Order Number	Description	Container	Units per Container	Minimum Order Quantity
EMBC01EVK	Proximity beacon, natural, evaluation samples	Individual	1	1
EMBC01-F401-H1000	Proximity beacon, natural, no logo	Tray	100	100
EMBC01-F401-H2000	Proximity beacon, natural, EM Micro logo	Tray	100	100
EMBC01-F401	Proximity beacon, PCB panel, no battery, holder, switch	Panel	14	280
EMBC01WMA-H0	Wall Mount accessory, natural	Bag	100	100
EMBC01KFA-H2	Key Fob accessory, blue	Bag	100	100
EMBC01WBA-H2	Watch Band Accessory, blue	Bag	100	100
EMBC01DVK	EMBC01 Development Kit, includes 5 beacons	Box	1	1
EMRLK6819	RLink	Box	1	1
EMRLKP6819	RLink Pro	Box	1	1

13. CONTACT INFORMATION

Inquiries for lead-times, quotes, orders:
EMDirect@emmicroelectronic.com

14. REFERENCE DOCUMENTS

EM9301   Device specification
EM6819   Device specification
Bluetooth Specification V4.0
Proximity Beacon Specification Release R1 Draft D