PB-04 Module

FAQ Summary

Firmware Release Version: V1.0.0
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Contents

1. What is the common process for OTA (Over-The-Air) DFU upgrade?

Answer: BLE OTA firmware update (commonly known as DFU — Device Firmware Update) is an essential capability for IoT devices.

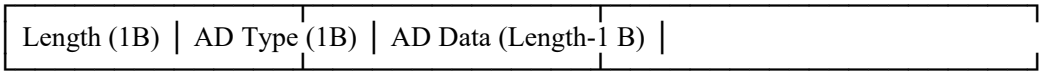
Typical Process:

1. The Mobile app connects to device → sends “Enter DFU mode” command.
2. The device switches to Bootloader and starts broadcasting the DFU Service.
3. The APP reconnects to the device in DFU mode.
4. The firmware package is transferred in chunks (20 to 244 bytes per chunk, depending on MTU).
5. The device sends an acknowledgment after each chunk is written.
6. Send CRC/signature verification after all transfers are complete.
7. Verification passed → device reboots to new firmware; verification failed → rollback/retry

Key Considerations:
- Ensure the Bootloader area is isolated from the App area to prevent bricking due to upgrade failure.
- The firmware package requires integrity verification (CRC32 / SHA256).
- Avoid powering off the device during the upgrade process.

2. What is the structure of a BLE advertising packet (ADV Data)?

Answer: A BLE advertising packet consists of multiple AD Structures. Each AD Structure format:



Each advertising packet can contain up to 31 bytes (ADV_IND), with each AD Structure concatenated in the payload.

Common AD Type Examples:

AD Type	Value	Description	Example Data
Flags	0x01	Device capability flags	[02 01 06] → LE General Discoverable + BR/EDR Not Supported
Complete Local Name	0x09	Complete device name	[08 09 4D 79 44 65 76 69 63 65] → “MyDevice”
TX Power Level	0x0A	Transmit power	[02 0A 00] → 0 dBm
Service UUID (16-bit)	0x03	Complete list of 16-bit service UUIDs	[03 03 0F 18] → Battery Service
Manufacturer Specific	0xFF	Manufacturer-defined data	The first 2 bytes are Company ID

3. What is MTU? Why is MTU negotiation needed?

Answer: MTU (Maximum Transmission Unit) is the maximum number of payload bytes that can be transmitted in a single transmission at the ATT layer.

Default MTU: 23 bytes (ATT_MTU), with only 20 bytes of effective data (minus 3 bytes of ATT header).
Through: GATT MTU Exchange can negotiate to a larger value (usually 247 bytes, maximum 512 bytes).
Impact: The smaller the MTU, the more fragmentation is required for large data packets → higher latency and lower throughput; the larger the MTU, the higher the efficiency per packet.

Recommendation: Initiate MTU negotiation as soon as the connection is established (Android/iOS typically handle this automatically via the system, while embedded systems require manual API calls).

4. How far can BLE communication reach? What factors affect it?

Answer: Typical communication range are as follows:

PHY Type	Theoretical Distance	Typical Actual Distance
LE 1M (default)	~100 m (open area)	10 ~ 50 m (indoors)
LE Coded PHY (BLE 5.0+)	~1000 m (open area)	50 ~ 200 m (indoors)
LE 2M PHY	~50 m	5 ~ 20 m (High-speed short-range)

Factors affecting actual distance:
- Transmit Power (Tx Power, typical -20 ~ +10 dBm)
- Antenna design/placement (PCB antenna vs. ceramic antenna vs. external antenna)
- Environmental obstructions (walls, human bodies, metal objects)
- 2.4 GHz co-channel interference (Wi-Fi, Zigbee, Microwave Ovens)

5. How to estimate the battery life of a BLE device?

Answer: Basic formula:

Battery life (days) = Battery capacity (mAh) / Average power consumption (mA) / 24

Typical Power Consumption Breakdown (Using nRF52832 as an Example):
Calculation Example (Temperature and Humidity Sensor, Coin Cell Battery CR2032 = 220 mAh):

Advertising phase: 100 seconds × 0.3 mA = 0.03 mAh
Connection + Reporting:: 1 second × 5 mA = 0.005 mAh
Sampling 0.001 × 1 mA ≈ 0
Sleep: Remaining quantity ≈ 0
Single connection consumption: ~0.035 mAh

220 mAh / 0.035 mAh ≈ 6285 connection events
Assuming 1 connection per hour: 6285 / 24 ≈ 261 days

Key points for extending battery life:
1. Replace GATT connections with connectionless Beacons.
2. Increase advertising/connection interval.
3. Disable unnecessary peripheral clocks and peripherals.
4. Using DC/DC regulator instead of an LDO.
5. Choose LE Coded PHY to balance distance and power consumption (air time needs to be considered).

Contact Information

Company Address: Rooms 403-405, 408-410, Building C, Huafeng Smart Innovation Port, Gushu, Xixiang, Bao’an District, Shenzhen

Contact Number: 0755-29162996

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