

FINAL SUBMISSION SPECIFICATION

Model: ZBY-78S

Product Name	Bluetooth module
Model	ZBY-78S
FCC ID	2A4PQ-ZBY-78S-1303
IC	29293-ZBY78S
HVIN	ZBY-78S



Revision History

Version	Date	Description	Prepared By
V1.0	2026-04-24	Formal lab submission version.	Wei



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1. Document Description

This specification describes the Bluetooth module ZBY-78S. The module is designed for UART transparent transmission applications and is based on the ST17H78S low-power 32-bit controller with BLE 5.0 capability.

The module supports BLE 5.0 RF PHY at 1 Mbps and 2 Mbps. It provides low power consumption, compact size, UART communication, configurable RF power, and AT command control for product customization.

1.1 Main Features

- Main controller: ST17H78S with SWD support.
- Memory: 96 KB ROM and 32 KB SRAM.
- Programmable retention in sleep mode and 16 KB OTP support.
- Operating voltage range: 1.8 V to 3.6 V.
- Integrated LDO and battery monitoring support.
- BLE 5.0 operation in the 2.4 GHz ISM band.
- Single antenna design without additional RF matching or RX/TX switching.
- AES-128 hardware encryption and RSSI reporting.

1.2 Default Application Requirements

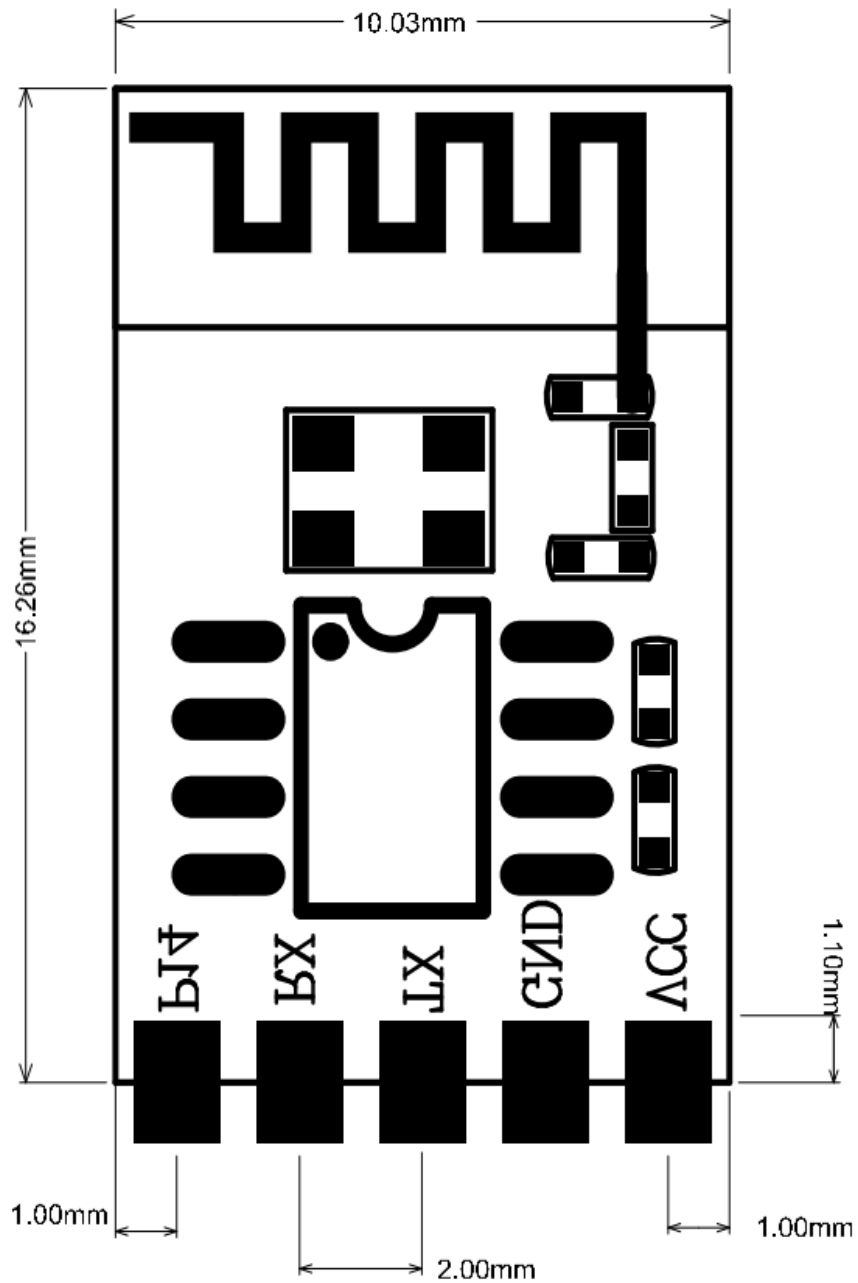
- Standard firmware baud rate: 115200 bps.
- Custom firmware baud rate: 9600 bps or 115200 bps.
- The module supports AT+MESHLOG=1 to enable log output.
- The module supports AT+MESHNAME=<name> to modify the Bluetooth name.
- The MAC address shall be included in advertising packets.
- For custom firmware, device information must be obtained after power-on before advertising starts.

2. Mechanical Structure

2.1 Basic Information

- PCB size: 10.03 mm x 16.26 mm x 1.0 mm PCBA.
- Number of pins: 5 pins.
- Antenna: onboard PCB antenna.

Figure 1. Module Outline and Package Dimensions



3. Electrical Characteristics

Standard measurement conditions: $T_a = 25^\circ\text{C}$, $V_{DD} = 3.3\text{ V}$, BLE low energy mode, 1 Mbps, GFSK modulation with 250 kHz deviation.

Item	Specification
Modulation	GFSK
Frequency Range	2400 MHz to 2483.5 MHz

Transmit Power	-23 dBm to 0 dBm, programmable by software
Operating Temperature	-20°C to +60°C
Storage Temperature	-40°C to +85°C
Supply Voltage	1.8 VDC to 3.6 VDC
Receive Sensitivity	-94 dBm typical
RX Current	9.1 mA typical at high gain setting
TX Current	9.5 mA typical at 0 dBm output
MCU Active Current	6.7 mA typical with 32 MHz crystal oscillator only
Power Mode 1 Current	270 uA typical, MCU standby, wake-up time 4 us
Power Mode 2 Current	0.9 uA typical, sleep timer active
Power Mode 3 Current	0.5 uA typical, deep sleep with hardware wake-up
Average Operating Current	Less than 500 uA
Standby Current	Less than 100 uA
Sleep Current	Less than 1 uA



4. Pin Definition

Pin No.	Pin Name	Type	Description
1	P14	Bluetooth connection status indication	Port P14
2	RX	Programming RX / UART RX	Receive data input
3	TX	Programming TX / UART TX	Transmit data output
4	GND	Power ground	Ground
5	VCC	Power input	1.8 V to 3.6 V

5. Operation Instructions

5.1 Default UART Parameters

- UART baud rate for standard firmware: 115200 bps.
- Data bits: 8 bit.
- Stop bits: 1 bit.
- Parity: none.
- Power ripple on the VCC pin shall not exceed 30 mV.
- VCC shall not exceed 3.6 V.

6. AT Command Overview

After power-on and successful startup, the module can be configured through UART by using AT commands. The following commands are supported in the standard command set.

Command	Function
AT+NAME	Query or set the module name.
AT+MAC	Query or set the module MAC address.
AT+CIVER	Query the firmware version.
AT+UART	Query or set the UART baud rate.
AT+AUTO+++	Enable or disable auto transparent mode after BLE connection.
AT+LINK	Query BLE connection status.
AT+ADVINT	Query or set the advertising interval.
AT+POWER	Query or set RF transmit power.
AT+UUID	Query the transparent service UUID information.
AT+DISCONN	Disconnect the current BLE connection.
AT++++	Enter transparent transmission mode.

AT+Z	Restart the module.
AT+RESET	Restore factory settings.
AT+FLASH	Save parameters to flash memory.
AT+RESE	Query or set custom advertising data.
AT+OFF	Enter power-off mode.
AT+MESHLOG=1	Enable log output.
AT+MESHNAME=<name>	Modify the Bluetooth device name.

7. Regulatory and Safety Statements

Certification identifiers for this product are listed below:

FCC ID	2A4PQ-ZBY-78S-1303
IC	29293-ZBY78S
HVIN	ZBY-78S



7.1 FCC Statement

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

To maintain compliance with FCC RF exposure guidelines, this equipment should be installed and operated with a minimum distance of 20 cm between the radiator and the user's body. Use only the supplied antenna.

Radiation Exposure Statement: This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

FCC Part 15.105 Class B Statement

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.

This equipment generates, uses and can radiate radio frequency energy.

If not installed and used in accordance with the instructions, it 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, 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.

OEM Integration Instructions (FCC KDB 996369 D03)

This module is authorized under Single Modular Approval for integration into host products by qualified OEM integrators.

The OEM integrator is responsible for ensuring the final host product complies with all applicable FCC rules, including Part 15 Subpart B where applicable.

End-user documentation must not include instructions to install or remove the RF module; such information is intended for OEM integrators only.

The host product label must display: Contains FCC ID: 2A4PQ-ZBY-78S-1303

Requirement per KDB 996369 D03

2.2 List of applicable FCC rules

This module complies with FCC Part 15.247 for DTS operation in the 2.4 GHz band.

2.3 Summarize the specific operational use conditions

This module is approved under Single Modular Approval for integration by qualified OEM integrators. It uses an onboard PCB antenna, operates in the 2400 MHz to 2483.5 MHz band, and must be installed with a minimum separation distance of 20 cm from the user. End-user documentation must not include instructions for module installation or removal.

2.4 Limited module procedures

Not applicable. This module is approved as a Single Modular Approval module and is not a limited modular approval.

2.5 Trace antenna designs

Not applicable. The module uses a permanently integrated onboard PCB antenna and does not support alternative trace antenna designs for host installation.

2.6 RF exposure considerations

This module complies with FCC RF exposure requirements for an uncontrolled environment. The host product must be installed and operated with a minimum distance of 20 cm between the radiator and the user. This module is designed to comply with the FCC statement, FCC ID:2A4PQ-ZBY-78S-1303

2.7 Antennas

The module uses a fixed onboard PCB antenna with a maximum gain of 0.18 dBi. No antenna substitution is permitted unless approved through a permissive change or new FCC certification filing.

2.8 Label and compliance information

The host product label must display the following text: Contains FCC ID: 2A4PQ-ZBY-78S-1303

2.9 Information on test modes and additional testing requirements

The host product manufacturer is responsible for additional compliance verification of the final host configuration. The OEM integrator must confirm that the final product continues to comply with all applicable FCC requirements in the installed configuration.

2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only authorized for the transmitter function. The final host product must comply with FCC Part 15 Subpart B requirements for unintentional radiators, where applicable.

2.11 Note EMI considerations

The host product should be designed so that module integration does not introduce additional EMI issues. Appropriate grounding, layout control, power supply filtering, and enclosure design must be used in the final host product as required.

2.12 How to make changes

Any changes or modifications to the module, antenna, or integration conditions that are not expressly approved by the grantee may void the authority to operate the equipment and may require a permissive change or a new FCC certification filing.

7.2 IC Statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). 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.

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

RF exposure statement: The equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

French statement: Cet appareil contient des émetteurs/récepteurs exemptés de licence conformes aux CNR d'Innovation, Sciences et Développement économique Canada. Le fonctionnement est soumis aux deux conditions suivantes: (1) Cet appareil ne doit pas produire de brouillage; (2) Cet appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Déclaration d'exposition RF: Cet équipement est conforme aux limites d'exposition aux rayonnements de l'IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec une distance minimale de 20 cm entre le radiateur et votre corps.