



DXYBT015-A00 Bluetooth Module Specification

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A) Overview

DXYBT015-A00 is a BLE wireless transparent transmission UART module based on onsemi ultra-low power BLE 5.2 wireless MCU, and designed by Shenzhen DXY Technology Co., Ltd. It supports AT command to change the UART baud rate, [Device name](#), Broadcast parameters, ...etc. We can also provide custom-made firmware service according to customer's requirement.

B) Main Features

- Ultra-low power BLE 5.2 standard
- Build in 32bit Cortex-M33 mcu core.
- RX sensitivity:
 - 1Mbps: -96dBm
 - 2Mbps: -94dBm
- TX power: 2.69dBm(max)
- Configure UART setting parameter.
- Small module size: 10mm(L)*9mm(W)*2.3mm(H)

C) Application

The module is mainly used in short distance wireless data transmission. Easy connection with mobile phone BLE & PC BLE. Data exchange is also possible in between two modules. This can replace wire cables and direct replacement of UART.

- BLE wireless data transmission
- Wireless data collection
- Industrial remote control, telemetry
- POS system, BLE wireless keyboard, mouse
- Automatic wireless data collection
- Building automation, security, smart door locks
- Smart home, industrial control

D) Physical Characteristics

Operating Frequency Band	2.4GHz ISM Band
Bluetooth Specification	Bluetooth v5.2 Low Energy (BLE)
Output Power Class	Class 2
Operating Voltage	3.3V
Host Interface	UART
Dimension	10mm(L)*9mm(W)*2.3mm(H)

E) Electrical Characteristics

Table 1 Recommended operating conditions

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
VCC	Power supply	Relative to GND	1.2V	3.3	3.6	V
TA	Operating temperature		-40	+25	+85	°C

Table2 DC Characteristics

(Typical values are Ta=25°C and VCC = 3.3V)

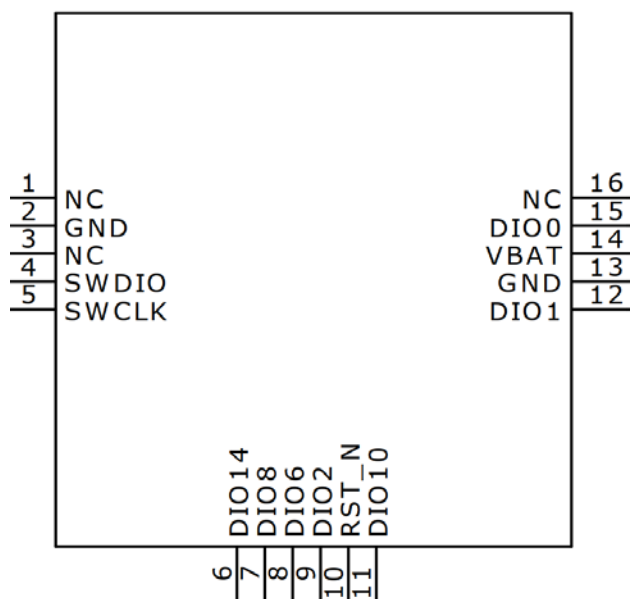
SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Icc	Current consumption	Sleep mode		0.08		uA
		RX mode(1Mbps)		2.7		mA
		RX mode(2Mbps)		3.2		mA
		TX mode(+0dBm)		4.3		mA
		TX mode(+6dBm)		11.4		mA
INTERFACE						
V(OH)	High level output voltage		0.9*Vcc			V
V(OL)	Low level output voltage				0.1*Vcc	V
V(IH)	High level input voltage		0.7*Vcc			V
V(IL)	Low level input voltage				0.3*Vcc	V

Table 3 RF receiver and transmitter characteristics

(Typical values are Ta=25°C and VCC = 3.3V)

SYMBOL	PARAMETERS	CONDITIONS	MIN	TYP	MAX	UNIT
	RX sensitivity (Non DC-DC)	1Mbps		-96		dBm
		2Mbps		-94		dBm
	Maximum input signal level			0		dBm
	Adjacent-channel rejection(C/I)	±1MHz		-1		dB
	Adjacent-channel rejection(C/I)	±2MHz		-40		dB
F	Frequency range		2400		2480	MHz
P(TX)	Output power		-17		6	dBm

F) Pin descriptions

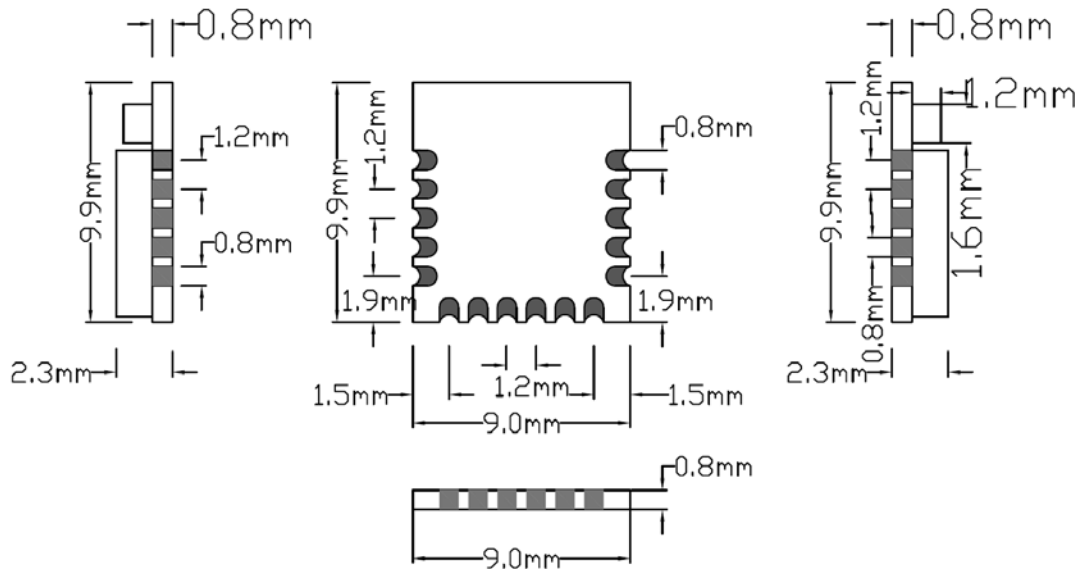


Pin No.	Pin Name	input/output	Pin Description
1	NC	--	--
2	GND	--	Analog GND, GND
3	NC	--	--
4	SWDIO	--	SWDIO
5	SWCLK	--	SWCLK
6	DIO14	IO	GPIO14
7	DIO8	IO	GPIO8, UART RX
8	DIO6	IO	GPIO6, UART TX
9	DIO2	IO	GPIO2
10	RESET	I	Reset pin, Low activate
11	DIO10	IO	GPIO10
12	DIO1	IO	GPIO1
13	GND		Analog GND, GND
14	VBAT	POWER	Module Power supply input (1.2V-3.6V)
15	DIO0	IO	GPIO0
16	NC	--	--

K) PCB package size and Layout Precautions

PCB package size:

Unit	: mm
Pad Tolerance	: +/-0.2
Appearance Tolerance	: +/-0.2



Layout notes

BLE module Layout, the upper & lower area of antenna cannot be covered by Copper GND. Besides, the bottom PCB side of antenna should be No Copper.

FCC regulatory conformance :

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.
- (2) This device must accept any interference received, including interference that may cause undesired operation.

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. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, 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, which can be determined by turning the equipment off and on, 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

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

ORIGINAL EQUIPMENT MANUFACTURER (OEM) NOTES

OEM must certify the final end product to comply with unintentional radiators (FCC Sections 07 and 15.109) before declaring compliance of the final product to Part 15 of the FCC rules and regulations. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change.

The OEM must comply with the FCC labeling requirements. If the module's label is not visible when installed, then an additional permanent label must be applied on the outside of the finished product which states: "Contains transmitter module FCC ID: 2A876-DXYBT015 ". Additionally, the following statement should be included on the label and in the final product's user manual: "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 interferences, and
- (2) this device must accept any interference received, including interference that may cause undesired operation."

The module is limited to installation in mobile or fixed applications. Separate approval is required for all other operating configurations, including portable configuration with respect to Part 2.1093 and different antenna configurations.

A module or modules can only be used without additional authorizations if they have been tested and granted under the same intended end-use operational conditions, including simultaneous transmission operations. When they have not been tested and granted in this manner, additional testing and/or FCC application filing may be required. The most straightforward approach to address additional testing conditions is to have the grantee responsible for the certification of at least one of the modules submit a permissive change application. When having a module grantee file a permissive change is not practical or feasible, the following guidance provides some additional options for host manufacturers. Integrations using modules where additional testing and/or FCC application filing(s) may be required are: (A) a module used in devices requiring additional RF exposure compliance information (e.g., MPE evaluation or SAR testing); (B) limited and/or split modules not meeting all of the module requirements; and (C) simultaneous transmissions for independent collocated transmitters not previously granted together.

Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change. (OEM) Integrator has to assure compliance of the entire end product include the integrated Module. Additional measurements (15B) and/or equipment authorizations (e.g. Verification) may need to be addressed depending on co-location or simultaneous transmission issues if applicable. (OEM) Integrator is reminded to assure that these installation instructions will not be made available to the end user

L) Revision history

Date	revision	desription
2022-03-15	1.0.0	Initial release
2022-06-26	1.0.1	Update AT Command
2022-11-18	1.0.2	Update PCB package

FCC MODULAR APPROVAL INFORMATION EXAMPLES for Manual

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.
- (2) This device must accept any interference received, including interference that may cause undesired operation.

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

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. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, 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, which can be determined by turning the equipment off and on, 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.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

OEM INTEGRATION INSTRUCTIONS:

This device is intended only for OEM integrators under the following conditions:

The module must be installed in the host equipment such that 20 cm is maintained between the antenna and users, and the transmitter module may not be co-located with any other transmitter or antenna. The module shall be only used with the internal on-board antenna that has been originally tested and certified with this module. External antennas are not supported. As long as these 3 conditions above are met, further transmitter test will not be required.

However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.). The end-product may need Verification testing, Declaration of Conformity testing, a Permissive Class II Change or new Certification. Please involve a FCC certification specialist in order to determine what will be exactly applicable for the end-product.

Validity of using the module certification:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization. In such cases, please involve a FCC certification specialist in order to determine if a Permissive Class II Change or new Certification is required.

Upgrade Firmware:

The software provided for firmware upgrade will not be capable to affect any RF parameters as certified for the FCC for this module, in order to prevent compliance issues.

End product labeling:

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: “Contains FCC ID: 2A876-DXYBT015 ”.

Information that must be placed in the end user manual:

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

“CAUTION : Exposure to Radio Frequency Radiation.
Antenna shall be mounted in such a manner to minimize the potential for human contact during normal operation. The antenna should not be contacted during operation to avoid the possibility of exceeding the FCC radio frequency exposure limit.

Frequency Range	Manufacturer	Peak gain	Impedance	Antenna type
2.4GHz-2.5GHz	YAGEO	5.05 dBi	50 Ω	Ceramic Antenna

Requirement per KDB996369 D03

2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.³

Explanation: This module meets the requirements of FCC part 15C(15.247).

2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.

Explanation:

The EUT has a ceramic Antenna, and the antenna use a permanently attached antenna which is not replaceable.

This EUT does not have RF shielding, additional evaluation is required for any system using this radio module.

The antenna's as listed in this application must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter procedures

End product should be operated with a minimum of 20 centimeters separation distance from any human body. See section 2.6 for additional RF Exposure detail.

2.4 Limited module procedures

If a modular transmitter is approved as a "limited module," then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions. A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

Explanation:

The module is a limited module. Any company of the host device which install this modular with limit modular approval should perform the test of radiated emission and spurious emission according to FCC part 15C: 15.247 and 15.209 requirement

Various factors should be avoided as far as possible to the wireless signal transmission and reception. Pay attention to the following What time is it: 1、 Avoid using metal for the product shell surrounding the Bluetooth. When using a part of the metal shell, try to keep the antenna part of the module away from the metal part. The metal connecting wire or metal screw inside the product should be as far away as possible from the antenna part of the module. 2、 The antenna part of the module should be placed against the edge of the carrier board PCB or directly exposed to the carrier board, and it is not allowed to be placed in the middle of the board, There is at least 5mm of free space in the antenna direction, and the carrier board under the antenna is milled out. Copper and wiring are not allowed in the direction parallel to the antenna. 3、 It is recommended to use insulating material to isolate the module mounting position on the substrate, for example, put a whole piece of sik screen at this position (Top Over Lay)

2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects:

layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.

- a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna);
- b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered);
- c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;
- d) Appropriate parts by manufacturer and specifications;
- e) Test procedures for design verification; and
- f) Production test procedures for ensuring compliance.

The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

Explanation: Yes, The module with trace antenna designs, and This manual has been shown the layout of trace design, antenna, connectors, and isolation requirements.

2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person's body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).

Explanation: This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment, This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body." This module is designed to comply with the FCC statement, FCC ID is: 2A876-DXYBT015.

2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an “omni-directional antenna” is not considered to be a specific “antenna type”)).

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: The EUT has a ceramic Antenna, and the antenna use a permanently attached antenna which is unique.

2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating “Contains FCC ID” with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

Explanation: The host system using this module, should have label in a visible area indicated the following texts: “Contains FCC ID: 2A876-DXYBT015”

2.9 Information on test modes and additional testing requirements⁵

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer’s determination that a module as installed in a host complies with FCC requirements.

Explanation: Top band can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Explanation: The module without unintentional-radiator digital circuitry, so the module does not require an evaluation by FCC Part 15 Subpart B. The host should be evaluated by the FCC Subpart B.