SPECIFICATION

TR4T100U1-A

Wi-Fi 802.11b/g/n+ Bluetooth LE 5.0 Module

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1. Device Overview

1.1 Descriptions

TR4T100U1-A is an intelligent new-generation highly integrated Wi-Fi and Bluetooth LE combined chip. The wireless subsystem includes 2.4G radio frequency, Wi-Fi 802.11b/g/n and BLE baseband/MAC design. The microcontroller subsystem contains a low-power 32-bit RISC CPU, cache and memory. The power management unit provides flexible settings to achieve low-power mode and supports various security functions.

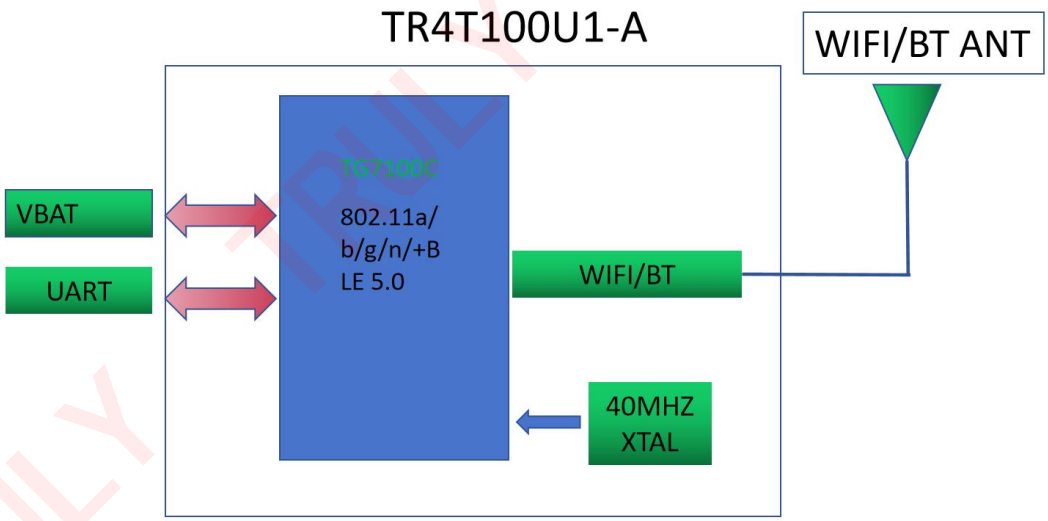
1.2 Features

- 802.11b/g/n, Wi-Fi + Bluetooth LE5.0 Combo, supporting STA, Soft AP and Sniffer
- It adopts an open-source and independently controllable RISC-V CPU, with a frequency range of 1 to 160 MHz, and 276KB SRAM
- Ultra-low power consumption: sleep power consumption is only 0.5uA, network connection standby power consumption is only 40uA (DTIM10)
- Ultra-fast connection: cold start fast connection is only 70ms
- Ultra-long distance: maximum transmission power is 21dBm, sensitivity is -98dBm, can penetrate one wall
- High security: supports secure boot, secure debugging, AES 128/192/256 encryption engine, WPA3, MD5, SHA-1/224/256, PKA (RSA/ECC) encryption engine
- Supports Wi-Fi and Bluetooth LE coexistence

1.3 Application Scenarios

- Smart lighting
- Smart switch
- Smart socket
- Smart home appliances
- Monitoring and remote control

1.4 Functional Block Diagram



2. Pin Configuration and Functions

2.1 Module PIN

TOP

BOTTOM

2.2 Pin

PIN	Name	Description
1	5V	DC 5V
2	GND	GND
3	RX	UART RX
4	TX	UART TX

3. Specifications

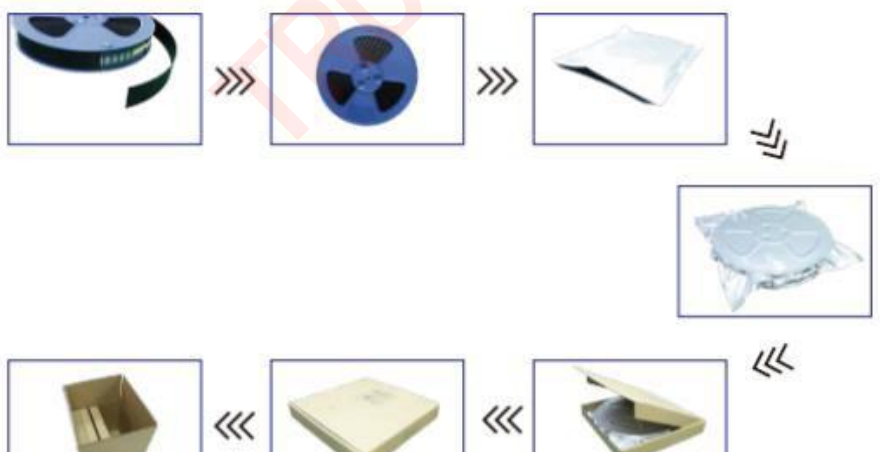
3.1 General Characteristics

TYPE	SPEC	description
	P/N	TR4T100U1-A
WIFI	Standard	IEEE 802.11b/g/n
	BAND	2.4~2.4835GHz ISM Band
	modulation	802.11b: CCK, DQPSK, DBPSK
		802. 11g: 64-QAM, 16-QAM, QPSK, BPSK
		802.11n: 64-QAM, 16-QAM, QPSK, BPSK
	Data Rate	1,2,5.5,6, 11, 12, 18,22,24,30,36,48,54,65,72.2Mbps
	modulation	IEEE 802.11b: DSSS
		IEEE802. 11g/n: OFDM
BT	Standard	BLE 5.0
	Band	2.402-2.480GHZ
hardware	Interface	UART
	Anetnna	PCB PIFA Antenna
	Operating Voltage	4.6~6V
	Operating current	Max：<350mA Average（STA）：40mA Average（STA，1KB/s）：60mA Average（AP)：70mA Min：310uA（Reset low）
	Ambient Temperature	-30℃ to +105℃
	Storage Temperature	-40℃ to +125℃
	Sizi	41.5mm×24.1mm×7.2mm
Software	Network type	Station / Soft AP
	Data Security	WEP/WPA-PSK/WPA2-PSK
	networking protocol	JPV4,TCP/UDP/HTTP
	Upgrade firmware	Local/Remote Wireless

4. Installation Precautions

- 4.1 Maintain a clear space around the module antenna and no metal objects should be present.
- 4.2 The module antenna should be installed outwardly, but it should not be close to the plastic casing. The distance should be more than 5mm.
- 4.3 The module should be kept away from strong interference sources such as motors, cameras, main control chips, and high-power power supplies.
- 4.4 The power supply voltage should be stable, with a fluctuation range controlled within 30mV.

5. Packaging (tape packaging or blister tray)



6. Order Information

Part NO.	Working Voltage	ANT	Shielding Cover	Remark
TR4T100U1-A	5V	PCB antennas	Included	UART

7. Revision History

Version	Change Content	Reviser	Date
V0.1	Draft Version	Grant	2025.05.21

FCC Statement

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.

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

The modular can be installed or integrated in mobile or fix devices only. This modular cannot be installed in any portable device.

Any company of the host which install this modular with Single modular approval should perform the test of radiated emissionand spurious emission according to FCC part 15C : 15.247 and 15.209 requirement, Only if the test result comply with FCC part 15C : 15.247 and 15.209 requirement, then the host can be sold legally.

FCC Radiation Exposure Statement

This modular complies with FCC RF 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. This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

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.

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/IC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID/IC 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/IC 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/IC 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 IC: 10531A-LM961”.

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.

2.2 List of applicable FCC/IC rules
List the FCC/IC 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/ICES-003) 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.
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 PCB antenna, and the antenna use a permanently attached antenna which is not replaceable.

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 not a limited module.

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/IC (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, "Contains Transmitter Module FCC ID: 2BOHYTR4T100U1 Or Contains FCC ID: 2BOHYTR4T100U1".

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 Monopole and Chip antenna, and the antenna use a permanently attached antenna which is unique.

Brand	Model Name	Antenna Type	Connector	Gain (dBi)	Note
HEYIXUN	TR4T100U1	PCB	N/A	2.53	N/A

2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC/IC 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 Transmitter Module FCC ID: 2BOHYTR4T100U1 Or Contains FCC ID: 2BOHYTR4T100U1".

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/IC 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/ICES-003 disclaimer

The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC/IC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC/IC 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/ICES-003 compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B/ICES-003 compliance testing with the modular transmitter installed.

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