



XHL-ALY Module Datasheet

WIFI+BT Module



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1 Product overview

XHL-ALY is a low-power embedded WiFi+BLE module that Tuya has developed. It consists of a highly integrated wireless RF chip (RTL8720CF), with an embedded WiFi network protocol stack and varied library functions. With the maximum CPU clock rate of 100MHz, WBR2L also contains a low-power KM4 microcontroller unit (MCU), a WLAN MAC, a 1T1R WLAN module, 256-KB static random-access memory (SRAM), 2-MB flash memory, and extensive peripherals.

XHL-ALY is an RTOS platform that integrates all function libraries of the WiFi MAC and TCP/IP protocols. You can develop embedded WiFi products as required.

1.1 Features

- Embedded low-power KM4 MCU, which can also function as an application processor
- Main clock rate: 100 MHz
- Working voltage: 3.0 to 3.6 V
- Peripherals: 5 GPIOs
- WiFi/BT connectivity

```
1 - 802.11 B/G/N20
2 - Channels 1 to 14 at 2.4 Ghz (channels 1 to 11 for US/CA and
   channe
3 ls 1 to 13 for EU/CN)
4 - Support WEP/WPA/WPA2/WPA2 PSK (AES) security modes
5 - Support BLE (Bluetooth Low Energy) 4.2
6 - Up to +20 dBm output power in 802.11b mode
```

- Support SmartConfig functions for Android and iOS devices
 - * Onboard PCB antenna
 - * Passed CE and FCC certification
 - * Working temperature: -20 to 105°C

1.2 Applications

- Intelligent building



- Smart household and home appliances
- Smart socket and light
- Industrial wireless control
- Baby monitor
- Network camera
- Intelligent bus

2 Change history

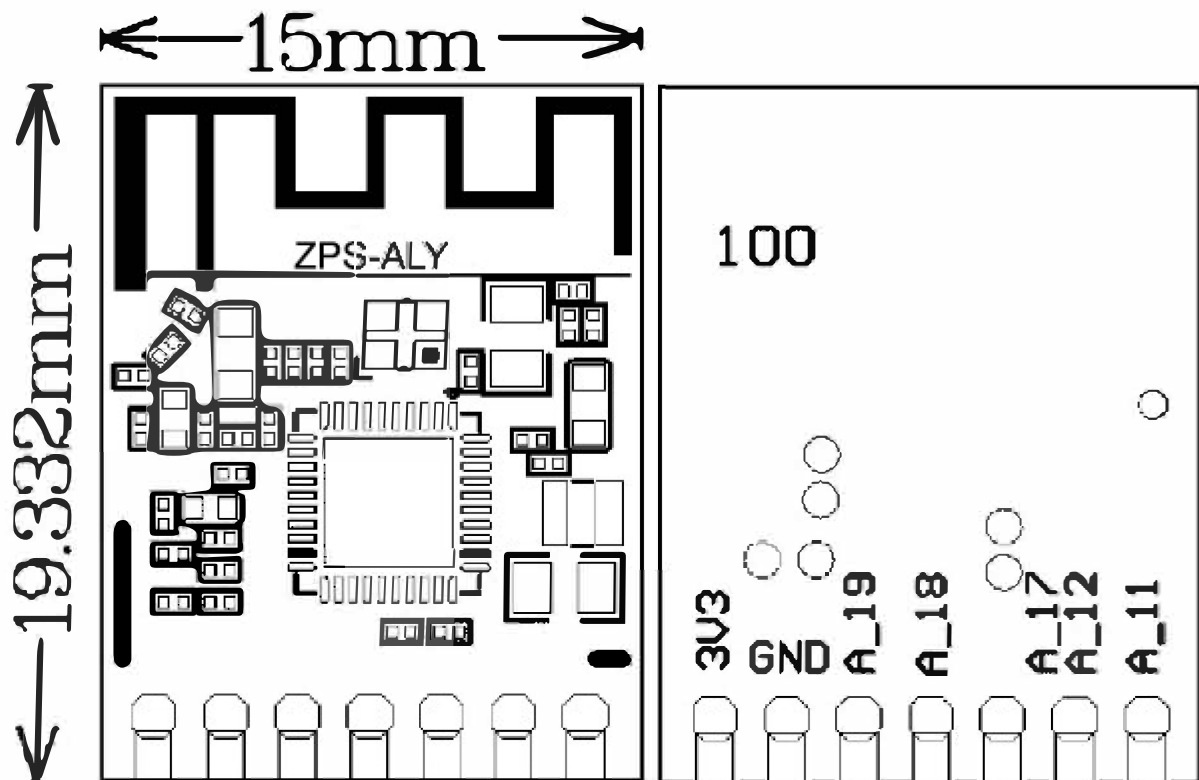
Update date	Updated content	Version after Update
07/21/2020	This is the first release.	V1.0.0

3 Module interfaces

3.1 Dimensions and footprint

XHL-ALY has two rows of pins with a 2 mm pin spacing. Each row has 8 pins.

The XHL-ALY dimensions are 15 ± 0.35 mm (W) $\times 19.3\pm0.35$ mm (L) $\times 2.9\pm0.15$ mm (H). The dimensions of WBR2L are as follows:



3.2 Pin definition



Pin Number	Symbol	I/O Type	Function
1	A_11	I/O	GPIOA_11, hardware PWM, IC Pin 25
2	A_12	I/O	GPIOA_12, hardware PWM, IC Pin 26
3	A_17	I/O	GPIOA_17, hardware PWM, IC Pin 38
4	A_18	I/O	GPIOA_18, hardware PWM, IC Pin 39
5	A_19	I/O	GPIOA_19, hardware PWM, IC Pin 40
6	GND	P	Power supply reference ground
7	3V3	P	Power supply pin (3.3V)

Note: P indicates power supply pins and I/O indicates input/output pins.

4 Electrical parameters

4.1 Absolute electrical parameters

Parameter	Description	Minimum value	Maximum value	Unit
Ts	Storage temperature	−40	125	°C
VDD	Power supply voltage	-0.3	3.6	V
Static electricity discharge voltage (human body model)	TAMB-25°C	-	2	KV
Static electricity discharge voltage (machine model)	TAMB-25°C	-	0.5	KV

4.2 Working conditions

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
Ta	Working temperature	-40	-	105	°C
VDD	Working voltage	3.0	-	3.6	V



4 ELECTRICAL PARAMETERS

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
VIL	I/O low-level input	-	-	0.8	V
VIH	I/O high-level input	2.0	-	-	V
VOL	I/O low-level output	-	-	0.4	V
VOH	I/O high-level output	2.4	-	-	V
I _{max}	IO drive current	-	-	16	mA
C _{pad}	Input pin capacitance	-	2	-	pF

4.3 RF power consumption

TX power consumption

Symbol	Mode	Power	Average value	Peak value (Typical value)	Unit
IRF	11b 11 Mbps	17 dBm	217	268	mA
IRF	11b 11 Mbps	18 dBm	231	283	mA
IRF	11g 54 Mbps	15 dBm	159	188	mA



4 ELECTRICAL PARAMETERS

Symbol	Mode	Power	Average value	Peak value (Typical value)	Unit
IRF	11g 54 Mbps	17.5 dBm	177	213	mA
IRF	11n BW20 MCS7	13 dBm	145	167	mA
IRF	11n BW20 MCS7	16.5 dBm	165	193	mA

RX power consumption

Symbol	Mode	Average value	Peak value (Typical value)	Unit
IRF	11B 11M	63	65	mA
IRF	11G 54M	65	67	mA
IRF	11N HT20 MCS7	65	67	mA

4.4 Working power consumption



Working Mode	Working Status, Ta = 25°C	Average value	Peak value (Typical value)	Unit
Quick connection network state	The module is in the fast network connection state and the WiFi indicator always flashes	75	324	mA
Network connection idle state	The module is connected to the network and the WiFi indicator is always on	64	314	mA
Network connection operation state	The module is connected to the network and the WiFi indicator is always on	66	305	mA
Disconnected state	The module is disconnected and the WiFi indicator is dark	66	309	mA

5 RF parameters

5.1 Basic RF features



Parameter	Description
Frequency range	2.400 to 2.4835 GHz
WiFi standard	IEEE 802.11b/g/n (channels 1 to 11)
BLE standard	Bluetooth 4.2
Data transmission rate	11b: 1, 2, 5.5, 11 (Mbps)
Data transmission rate	11g: 6, 9, 12, 18, 24, 36, 48, 54 (Mbps)
Data transmission rate	11n: HT20 MCS0 to 7
Antenna type	PCB antenna with a gain of 1.93 dBi

5.2 TX performance

Parameter	Minimum value	Typical value	Maximum value	Unit
Average RF output power, 802.11b CCK Mode 1M	-	17.5	-	dBm
Average RF output power, 802.11g OFDM Mode 54M	-	14.5	-	dBm
Average RF output power, 802.11n OFDM Mode MCS7	-	13.5	-	dBm
Average RF output power, BLE 4.2 1M	-	6.5	-	dBm



Parameter	Minimum value	Typical value	Maximum value	Unit
Frequency error	-20	-	20	ppm
EVM@802.11b CCK 11 Mbps Mode 17.5 dBm	-	-	-10	dB
EVM@802.11g OFDM 54 Mbps Mode 14.5 dBm	-	-	-29	dB
EVM@802.11n OFDM MCS7 Mode 13.5 dBm	-	-	-30	dB

5.3 RX performance

Parameter	Minimum value	Typical value	Maximum value	Unit
PER<8%, RX sensitivity, 802.11b CCK Mode 1M	-	-91	-	dBm
PER<10%, RX sensitivity, 802.11g OFDM Mode 54M	-	-75	-	dBm



Parameter	Minimum value	Typical value	Maximum value	Unit
PER<10%, RX sensitivity, 802.11n OFDM Mode MCS7	-	-72	-	dBm
PER<10%, RX sensitivity, BLE 4.2 1M	-	-93	-	dBm

6 Antenna

6.1 Antenna type

XHL-ALY uses only an on board PCB antenna with a gain of 1.93 dBi.

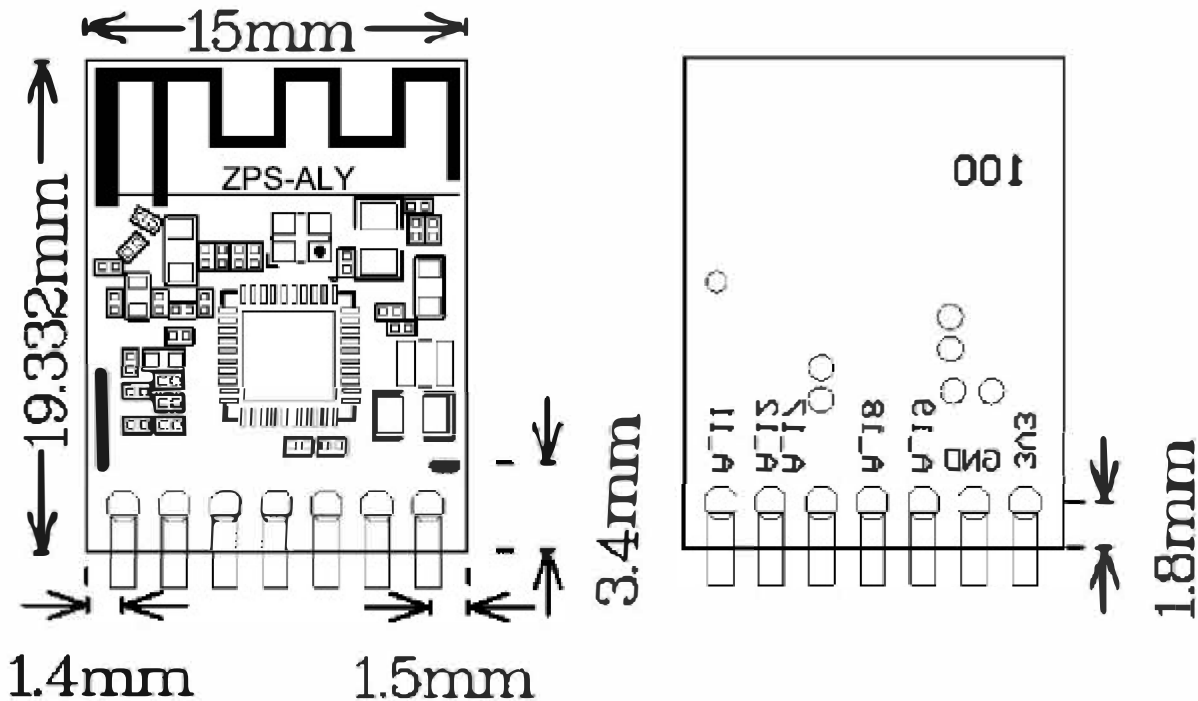
6.2 Antenna interference reduction

To ensure optimal WiFi performance when the WiFi module uses an on board PCB antenna, it is recommended that the antenna be at least 15 mm away from other metal parts.

7 Packaging information and production instructions

7.1 Mechanical dimensions

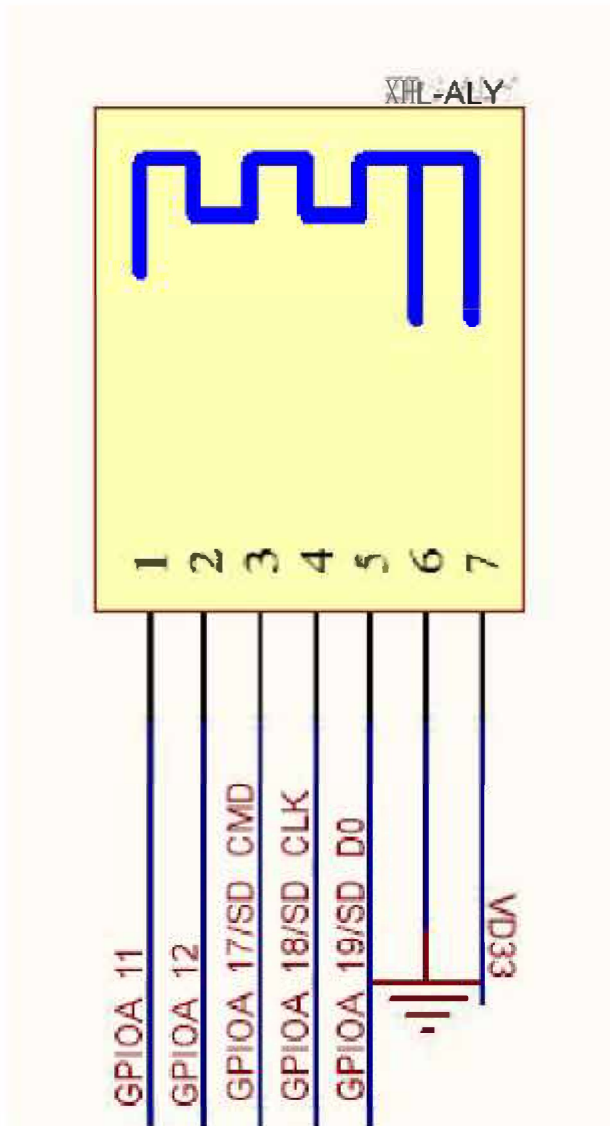
The mechanical dimensions of the PCB of XHL-ALY are 15 ± 0.35 mm (W) $\times$ 19.3 ± 0.35 mm (L) $\times$ 0.8 ± 0.1 mm (H). The following figure shows the mechanical dimensions of XHL-ALY.



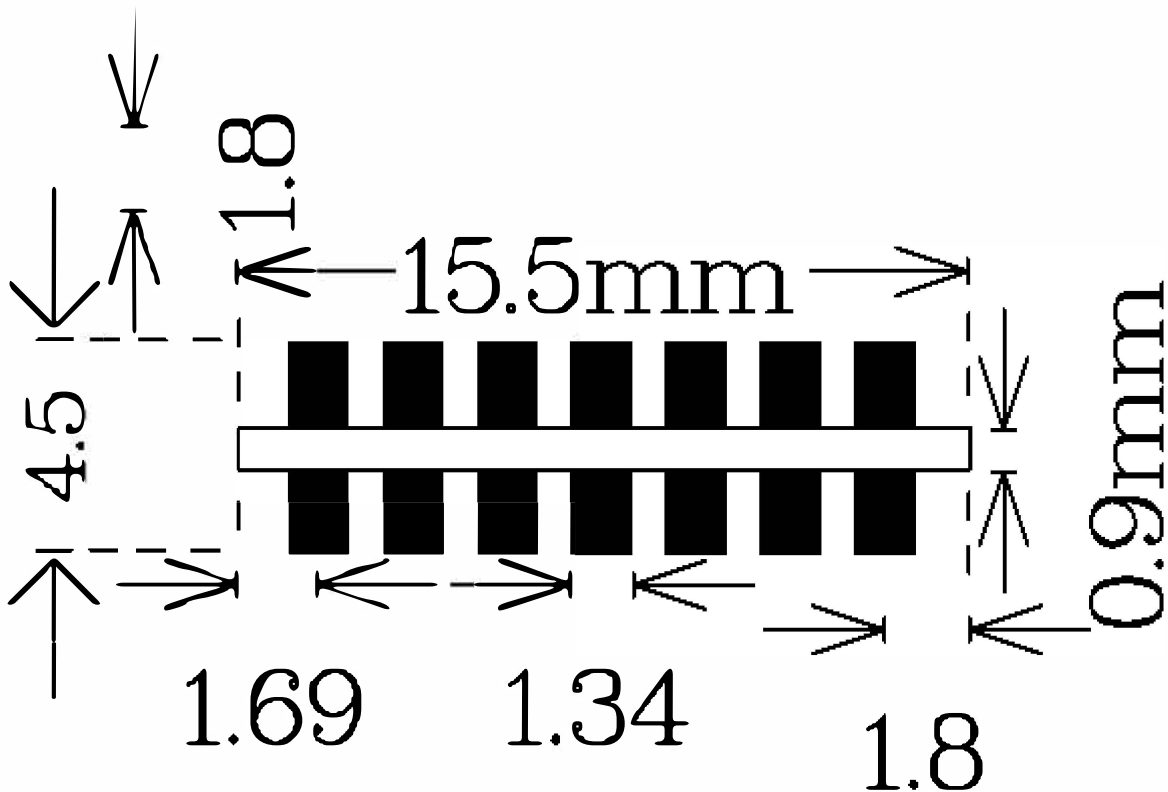
Note: The default dimensional tolerance is ± 0.35 mm. If you have specific requirements on dimensions, make them clear in the datasheet after communication.

7.2 Recommended PCB layout

The following figure is a schematic diagram of XHL-ALY which shows how pins correspond to each other.



WBR2L PCB Layout is shown as below:



7.3 Production instructions

1. For the in-line module developed by Tuya, wave soldering equipment is most preferred and manual soldering is less preferred. After unpacking, the module must be soldered within 24 hours; otherwise, vacuum packaging needs to be carried out again.

- Soldering equipment and materials:
 - Wave soldering equipment
 - Wave soldering fixture
 - Constant-temperature soldering iron
 - Tin bar, tin wire, flux
 - Oven temperature tester
- Baking equipment:
 - Cabinet oven
 - Anti-static heat-resistant trays
 - Anti-static heat-resistant gloves

2. The module developed by Tuya needs to be baked in the following cases:

- Vacuum packaging bag was damaged before unpacking.
- There is no humidity indicator card (HIC) in the vacuum packaging bag.
- After unpacking, 30% and above circles on the HIC become pink.
- Production is not completed within 72 hours after unpacking.
- More than 6 months have passed since the date of sealing the bag.

3. Baking settings:

- Baking temperature: reel packing $65\pm5^{\circ}\text{C}$, pallet packing $125\pm5^{\circ}\text{C}$
- Baking time: reel packing 48 hours, pallet packing 12 hours
- Alarm Temperature: reel packing 70°C , pallet packing 130°C
- Production ready temperature after natural cooling: $< 36^{\circ}\text{C}$
- The number of drying times: 1
- Rebaking condition: The module is not soldered within 72 hours after baking

4. Do not use wave soldering to process modules that have been unpacked for more than 3 months, because electroless nickel/immersion gold (ENIG) is used for PCBs and they are seriously oxidized after more than 3 months. Wave soldering is very likely to cause pseudo and missing soldering. Tuya is not liable for such problems and consequences.

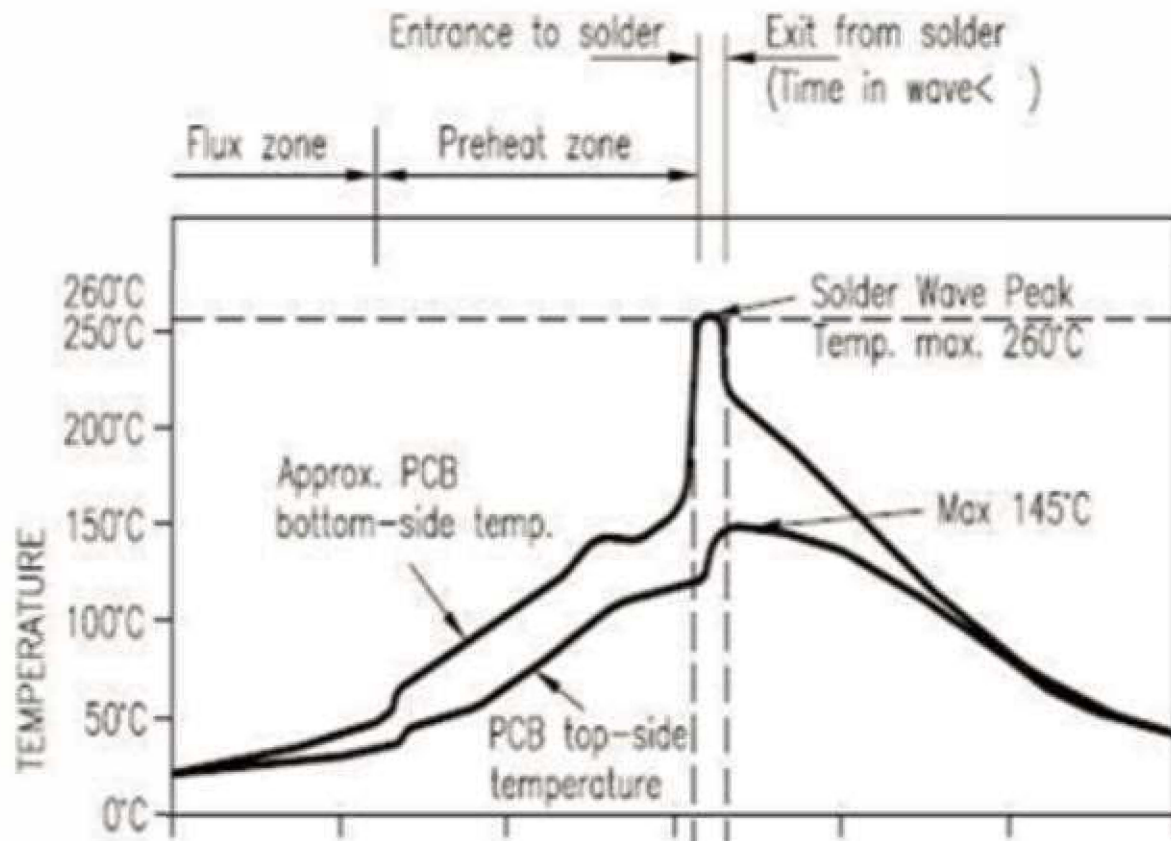
5. In the production process, take electrostatic discharge (ESD) protective measures.

6. To ensure the quality of products, you should pay attention to the amount of soldering flux, the height of the wave peak, whether the tin slag and copper content in the wave soldering tank exceed standards, whether the window and thickness of the wave soldering fixture are appropriate, and whether the wave soldering oven temperature curve is reasonable.

7.4 Recommended oven temperature curve and temperature

For oven temperature setting, refer to oven temperatures for wave soldering. The peak temperature is $260^{\circ}\text{C}\pm5^{\circ}\text{C}$. The wave soldering temperature curve is as below:

DIP Type Product Pass Wavesolder Graph



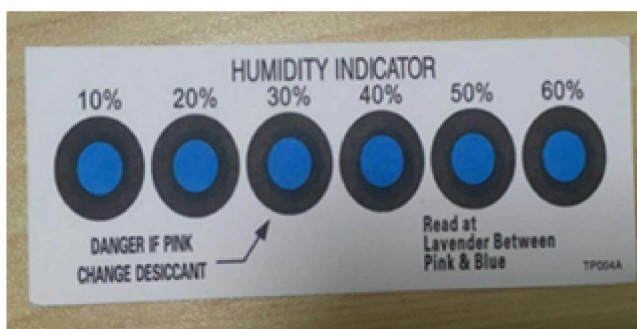
Recommended soldering temperature:

Recommended Wave Soldering Oven Temperature Curve		Recommended Manual Soldering Temperature	
Pre-heat temperature	80 to 130°C	Soldering temperature	360 ± 20°C
Pre-heat time	75 to 100s	Soldering time	< 3s/point
Peak contact time	3 to 5s	NA	NA
	260 ± 5°C	NA	NA
	≤ 2°C/s	NA	NA
Ramp-down slope	≤ 6°C/s	NA	NA

7.5 Storage conditions

Storage conditions for a delivered module are as follows:

- The moisture-proof bag is placed in an environment where the temperature is below 30°C and the relative humidity is lower than 70%.
- The shelf life of a dry-packaged product is 6 months from the date when the product is packaged and sealed.
- The package contains a humidity indicator card (HIC).



	CAUTION This bag contains MOISTURE-SENSITIVE DEVICES	LEVEL 3 If Blank, see adjacent bar code label
1. Calculated shelf life in sealed bag: 12 months at $< 40^{\circ}\text{C}$ and $< 90\%$ relative humidity (RH)		
2. Peak package body temperature: <u>260</u> $^{\circ}\text{C}$ If Blank, see adjacent bar code label		
3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must		
a) Mounted within: <u>168</u> hrs. of factory conditions If Blank, see adjacent bar code label		
$\leq 30^{\circ}\text{C}/60\%\text{RH}$, OR		
b) Stored at $<10\%$ RH		
4. Devices require bake, before mounting, if:		
a) Humidity Indicator Card is $> 10\%$ when read at $23 \pm 5^{\circ}\text{C}$		
b) 3a or 3b not met.		
5. If baking is required, devices may be baked for 48 hrs. at $125 \pm 5^{\circ}\text{C}$		
Note: If device containers cannot be subjected to high temperature or shorter bake times are desired, reference IPC/JEDEC J-STD-033 for bake procedure		
Bag Seal Date: _____ If Blank, see adjacent bar code label		
Note: Level and body temperature defined by IPC/JEDEC J-STD-020		

8 MOQ and packaging information

Product Number	MOQ (pcs)	Shipping packaging method	The number of modules per reel (pcs)	The number of reels per carton (reel)
XHL-ALY	4800	Tape reel	1200	4

9 Appendix: Statement

FCC Statements:

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.

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.

Warning: Changes or modifications to this unit not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

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.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

2.2 LIST OF APPLICABLE FCC RULES:

Compliance with § 15.247 regulation

2.3 SPECIFIC OPERATIONAL USE CONDITIONS:

The module is typically use in industrial, household and general office / ITE and audio & video, EV charging system end-products. The product must not be co-located or operating in conjunction with any other antenna or transmitters.

2.4 LIMIT MODULE PROCEDURES:

Not applicable as this radio module meets the Single-Modular transmitter requirements.

2.5 TRACE ANTENNA DESIGNS:

The module was designed with the fixed PCB print antenna and the maximum gain is about 1.93dBi between 2400-2500MHz, any changes or modifications by the OEM integrator will require additional testing and evaluation.

2.6 RF EXPOSURE CONSIDERATIONS:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This product must be installed and operated with a minimum distance of 20 cm between the radiator and user body. OEM integrator shall equipped the antenna to compliance with antenna requirement part 15.203& 15.204 and must not be co-located or operating in conjunction with any other antenna or transmitters, otherwise, a Class II Permissive Change (C2PC) must be filed with the FCC and/or a new FCC authorization must be applied.

2.7 ANTENNAS:

The antenna of the module was deisgned as PCB printed on the PCBA board and the best gain is about 1.93dBi between 2400-2500MHz. Modification the antenna design may need additional testing and evaluation.

2.8 LABEL AND COMPLIANCE INFORMATION:

The final end product must be labelled in a visible area with the following "Contains TX FCC ID: 2A9TCXHL-ALY " or "Contains Transmitter Module FCC ID: 2A9TCXHL-ALY ". If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users' 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, and (2) this device must accept any interference received, including interference that may cause undesired operation.

A user's manual for the finished product should include one of the following statements:

For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

statement, placed in a prominent location in the text of the manual:

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.

The User's Manual for The finished product should include the following statements:

Any changes or modifications to this equipment not expressly approved by the OEM/Integrator may cause harmful interference and void the user's authority to operate this equipment.

RF Exposure

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This product must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

2.9 INFORMATION ON TEST MODES AND ADDITIONAL TESTING REQUIREMENTS:

Data transfer module demo board can control the EUT work in RF test mode at specified conditions. This radio module must not be installed to co-locate and operating simultaneously with other radios in the host system except in accordance with FCC multi-transmitter product procedures. Additional testing and equipment authorization may be required operate simultaneously with other radio.

This device is intended only for OEM integrators under the following conditions: 1) The antenna must be installed such that 20cm is maintained between the antenna and users, and 2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as the 2 conditions above are met, further transmitter tests 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.

2.10 ADDITIONAL TESTING, PART 15 SUBPART B DISCLAIMER:

The host product manufacturer is responsible for compliance with any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

General Statements

The module is intended only for OEM integrators.

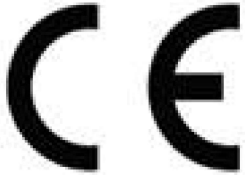
The OEM integrator is responsible for ensuring that the end-user has no manual instruction to remove or install module.

The OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed

OEM integrator shall not modify and change the fixed designed PCB print antenna, and must not be co-located or operating in conjunction with any other antenna or transmitters, otherwise, a Class II Permissive Change (C2PC) must be filed with the FCC and/or a new FCC authorization must be applied.

.The product is typically use in industrial, household and general office / ITE and audio & video, EV charging system end-products.

Declaration of Conformity European notice



Hereby, Dongguan XinhailinTechnology Co., Ltd. declares that this module product is in compliance with essential requirements and other relevant provisions of Directive 2014/53/EU, 2011/65/EU. A copy of the Declaration of conformity can be found at <http://www.xinhailin.com>



This product must not be disposed of as normal household waste, in accordance with the EU directive for waste electrical and electronic equipment (WEEE-2012/19/EU). Instead, it should be disposed of by returning it to the point of sale, or to a municipal recycling collection point.