



# **BL-R8189RM2**

**802.11n 150Mbps WLAN**

**SDIO Module Specification**

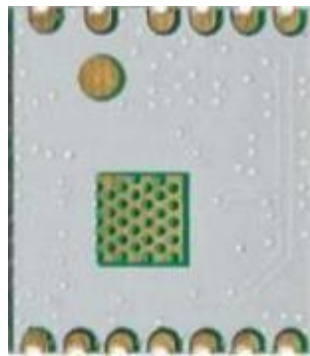
**SHENZHEN BILIAN ELECTRONIC CO., LTD**

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( Top View )



( Bottom View )

Module Name: BL-R8189RM2	
Module Type: 802.11b/g/n 150Mbps 1T1R SDIO WLAN Module	
Revision: V1.4	
Customer Approval:	
Company:	
Title:	
Signature:	Date:
BL-link Approval:	
Title:	
Signature:	Date:

## Revision History

Revision	Summary	Release Date	Revised By
1.0	Initial release	2020-07-18	
1.4	Content optimization	2023-04-15	Cxf

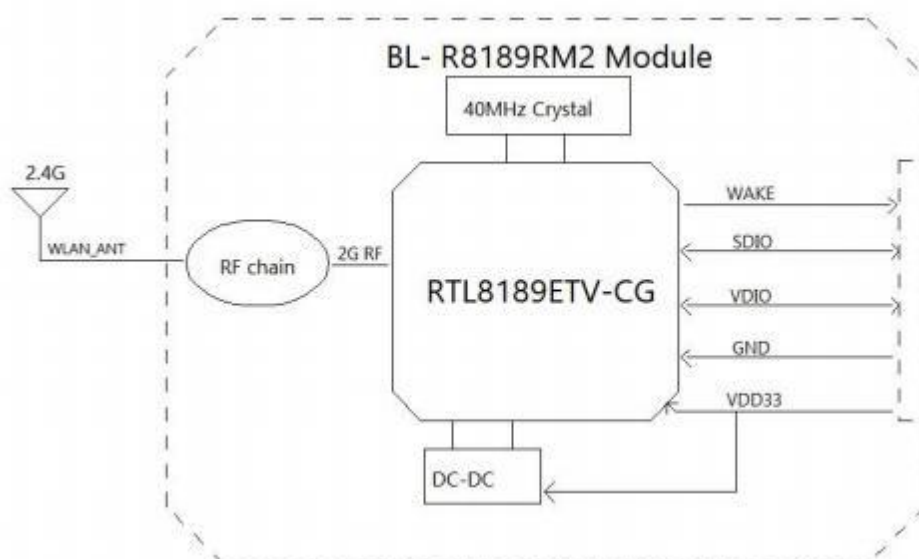
## 1. Introduction

BL- R8189RM2 product Accord with FCC CE and is 150 wireless SDIO adapter which has lower power consumption, high linearity output power, accords with IEEE802. 11b/g/n, and supports IEEE802. 11i safety protocol, along with IEEE 802. 11e standard service quality. It connects with other wireless device which accorded with these standards together, supports the new data encryption on 64/128 bit WEP and safety mechanism on WPA- PSK/WPA2 - PSK, WPA/WPA2. Its wireless PHY rate can reach up to 150Mbps, equivalent to 10 times of common 11b product. The inner AI high gain ceramics antenna adapts different kinds of work environment. It' s easy and convenient to link to wireless network for the users using desktop, laptop and other device that needs connect to wireless network.

### 1.1 Features

- 👉 Operating Frequencies: 2.4~2.4835GHz
- 👉 Host Interface is SDIO 1.1/2.0/3.0
- 👉 IEEE Standard: IEEE 802.11b/g/n
- 👉 Wireless PHY rate can reach up to 150Mbps
- 👉 Connect to external antenna through half hole pad
- 👉 Power Supply: DC 3.3V main power and 1.8V/3.3V I/O power

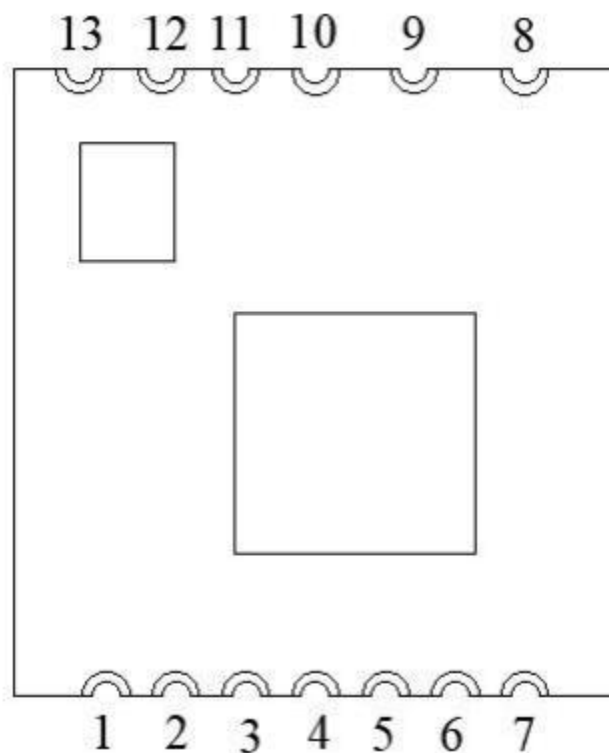
### 1.2 Block Diagram



## 1.3 General Specifications

Module Name	BL-R8189RM2
Chipset	RTL8189ETV-CG
WLAN Standards	IEEE802.11 b/g/n
Host Interface	SDIO 3.0 for WLAN
Antenna	Connect to the external antenna through half hole
Dimension	14*12.5*1.5mm (L*W*H)
Power Supply	DC 3.3V±0.2V @ 350 mA (Max) DC 3.3V±0.2V or 1.8V±0.1V I/O power supply
Operation Temperature	-20°C to +70°C
Operation Humidity	10% to 95% RH (Non-Condensing)

## 2. Pin Assignments



(Top view)

## 2.1 Pin Definition

No	Pin Name	Type	I/O Level	Description
1	SDIO_CMD	I/O	VDIO	SDIO command/GSPI data input
2	SDIO_D3	I/O	VDIO	SDIO data 3 /GSPI chip select
3	SDIO_D2	I/O	VDIO	SDIO data 2
4	SDIO_D1	I/O	VDIO	SDIO data 1 /GSPI data out
5	SDIO_D0	I/O	VDIO	SDIO data 0 /GSPI data output
6	SDIO_CLK	I	VDIO	SDIO clock /GSPI clock
7	GND	P		Ground connections.
8	GND	RF		RF Ground for WLAN_ANT
9	WLAN_ANT	RF		2.4G RF PAD for WLAN_ANT
10	WAKE	I/O	VDIO	WLAN wake
11	VDIO	P		VDIO for SDIO pin, the power supply is same as the signal level of SDIO bus. Base on platform to choose 3.3V or 1.8V.
12	VDD33	P		DC 3.3V Main power supply.
13	CS	I/O	VDIO	Power down select

P: Power, I: Input, O: Output, I/O: In/Output, RF: Analog RF Port

## 3. Electrical and Thermal Specifications

### 3.1 Recommended Operating Conditions

Parameters	Min	Typ	Max	Units	
Ambient Operating Temperature	-20	25	70	°C	
External Antenna VSWR	/	1.7	2.0	/	
Supply Voltage	VDD33	3.1	3.3	3.5	V
	VDIO	1.7	1.8	1.9	V
		3.1	3.3	3.5	V

### 3.2 Digital 3.3V I/O DC Specifications

Symbol	Parameter	Min	Typ	Max	Units
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VIH	Input High Voltage	2.0	3.3	3.6	V
VIL	Input Low Voltage	--	0	0.9	V
VOH	Output High Voltage	2.97	--	3.3	V
VOL	Output Low Voltage	0	--	0.33	V

### 3.3 Digital 1.8V I/O DC Specifications

Symbol	Parameter	Min	Typ	Max	Units
VIH	Input High Voltage	1.7	1.8	2.0	V
VIL	Input Low Voltage	--	0	0.8	V
VOH	Output High Voltage	1.62	--	1.8	V
VOL	Output Low Voltage	0	--	0.18	V

### 3.4 Current Consumption

Conditions : VDD33 = 3.3V ; Ta:25°C			
Use Case	VDD33 Current (average)		
	Typ	Max	Units
WLAN Unassociated (Linux Driver)	185	198	mA
2.4G 11b@1Mbps TX_17dBm (RF-Test)	320	340	mA
2.4G 11b@11Mbps TX_17dBm (RF-Test)	230	242	mA
2.4G 11g@6Mbps TX_16dBm (RF-Test)	255	268	mA
2.4G 11g@54Mbps TX_14dBm (RF-Test)	190	203	mA
2.4G 11n@HT20_MCS0 TX_16dBm (RF-Test)	244	253	mA
2.4G 11n@HT20_MCS7 TX_14dBm (RF-Test)	192	198	mA
2.4G 11n@HT40_MCS0 TX_15dBm (RF-Test)	236	248	mA
2.4G 11n@HT40_MCS7 TX_13dBm (RF-Test)	183	195	mA
2.4G 11b@11Mbps RX (RF-Test)	139	142	mA
2.4G 11g@6Mbps RX (RF-Test)	140	145	mA
2.4G 11n@HT40_MCS0 RX (RF-Test)	140	145	mA
2.4G 11n@HT40_MCS7 RX (RF-Test)	145	150	mA

## 4. WLAN RF Specifications

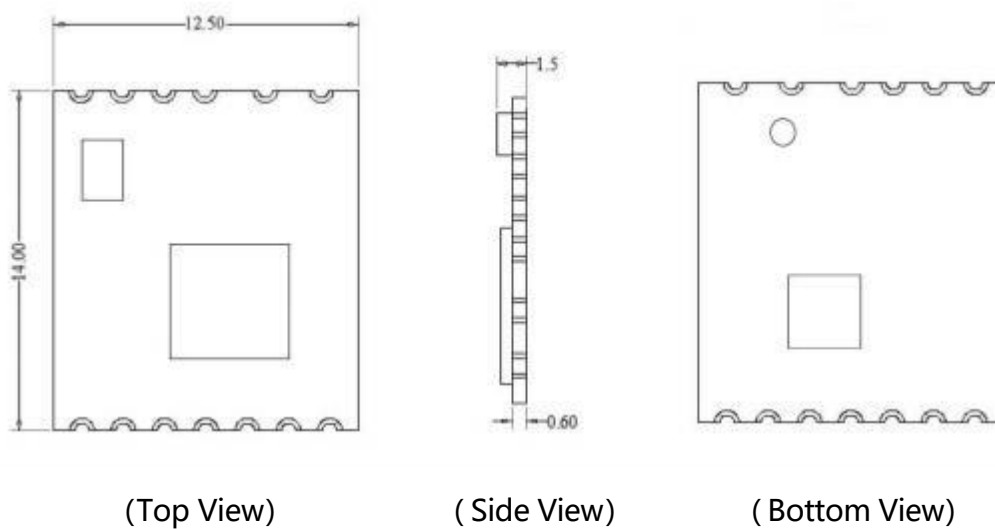
### 4.1 2.4G WLAN RF Specification

Conditions : VDD33 =3.3V ; Ta:25°C			
Features	Description		
WLAN Standard	IEEE 802.11b/g/n		
Frequency Range	2.4~2.4835GHz (2.4GHz ISM Band)		
Channels	Ch1~Ch13 (For 20MHz Channels)		
Modulation	802.11b (DSSS): CCK, DQPSK, DBPSK; 802.11g (OFDM): BPSK, QPSK, QAM16, QAM64; 802.11n (OFDM): BPSK, QPSK, QAM16, QAM64;		
Data Rate	802.11b: 1, 2, 5.5, 11Mbps; 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps; 802.11n (HT20): MCS0~MCS7 6.5~72.2Mbps; 802.11n (HT40): MCS0~MCS7 13.5~150Mbps;		
Frequency Tolerance	≤±20ppm		
<b>2.4G Transmitter Specifications</b> (TX power of some rates is calibrated, customers can define the target TX power of other rates by modifying configuration file of the driver software. Customers must define the TX power same or lower than recommended Target TX Power as below)			
TX Rate	TX Power (dBm)	TX Power Tolerance (dBm)	EVM (dB)
802.11b@1Mbps	Recommended Target TX Power :17	±1.5	≤-10
802.11b@11Mbps	Calibrated TX Power : 17	±1.5	≤-10
802.11g@6Mbps	Recommended Target TX Power :16	±1.5	≤-10
802.11g@54Mbps	Calibrated TX Power : 14	±1.5	≤-25
802.11n@HT20_MCS0	Recommended Target TX Power :16	±1.5	≤-10
802.11n@HT20_MCS7	Calibrated TX Power : 14	±1.5	≤-28
802.11n@HT40_MCS0	Recommended Target TX Power :15	±1.5	≤-10
802.11n@HT40_MCS7	Calibrated TX Power : 13	±1.5	≤-28
<b>2.4G Receiver Specifications</b>			
RX Rate	Min Input Level (Typ.dBm)	Max Input Level (Typ.dBm)	PER

802.11b@1Mbps	-92	-10	< 8%
802.11b@11Mbps	-86	-10	< 8%
802.11g@6Mbps	-88	-10	< 10%
802.11g@54Mbps	-72	-10	< 10%
802.11n@HT20_MCS0	-87	-10	< 10%
802.11n@HT20_MCS7	-68	-10	< 10%
802.11n@HT40_MCS0	-85	-10	< 10%
802.11n@HT40_MCS7	-65	-10	< 10%

## 5. Mechanical Specifications

### 5.1 Module Outline Drawing



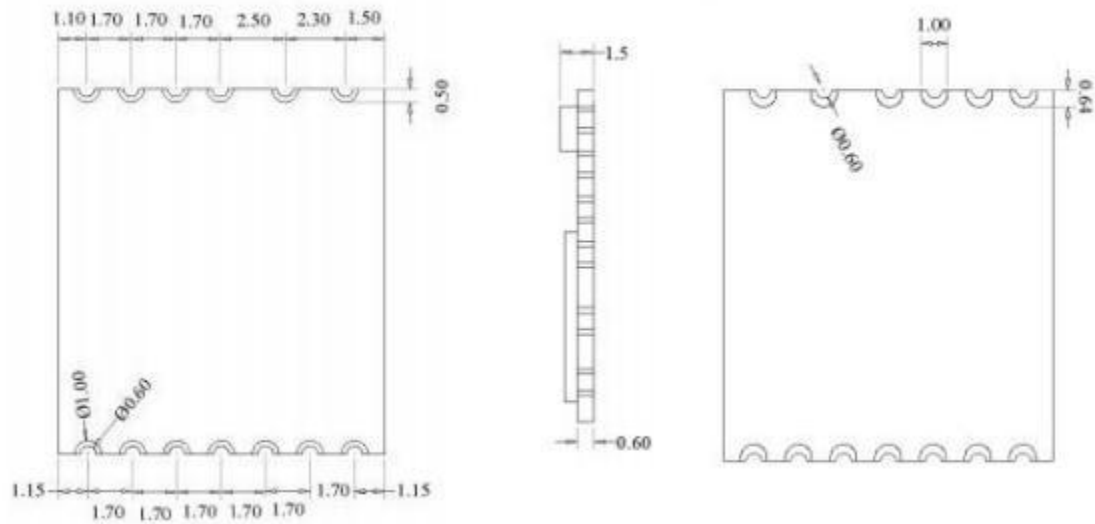
Module dimension: 14.0\*12.5\*1.5mm (L\*W\*H; Tolerance:  $\pm 0.15$ mm)



Module Bow and Twist:  $\leq 0.1$ mm



## 5.2 Mechanical Dimensions



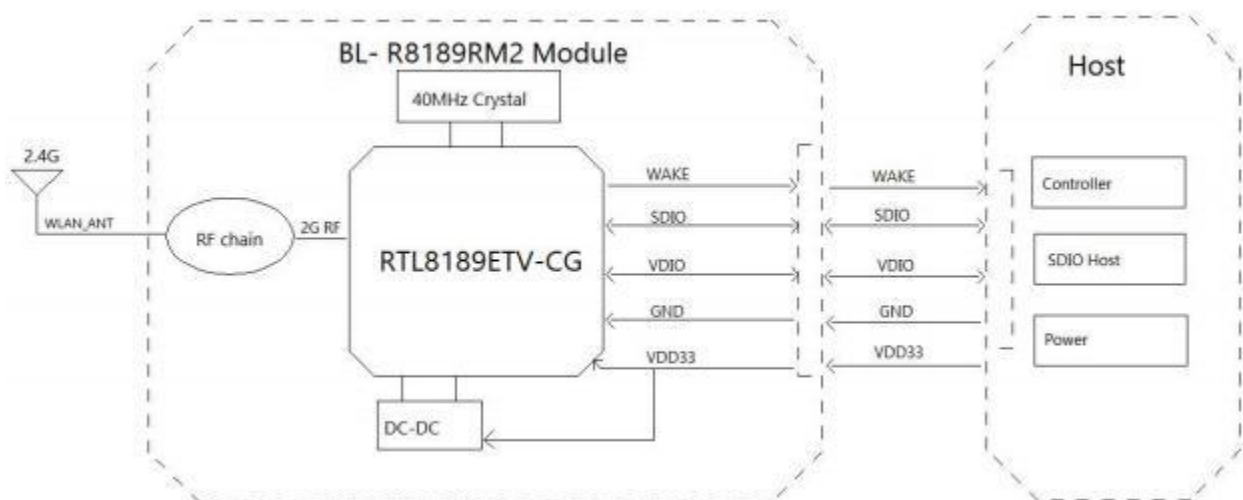
(Top View)

(Side View)

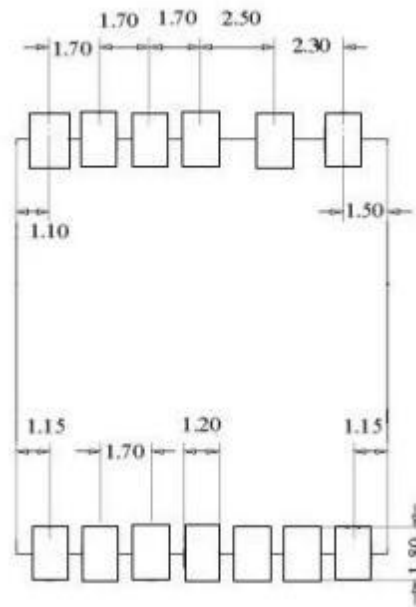
(Bottom View)

## 6. Application Information

### 6.1 Typical Application Circuit

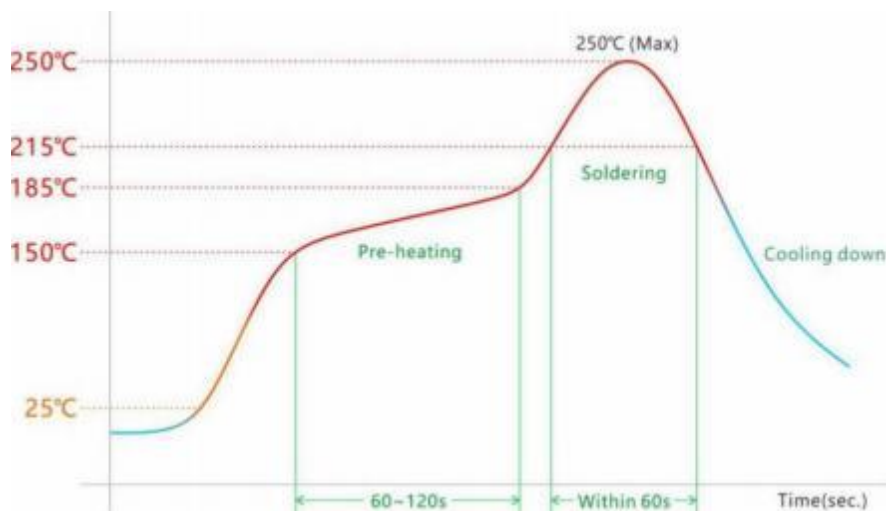


## 6.2 Recommend PCB Layout Footprint



( Design size: mm )

## 6.3 Reflow Soldering Standard Conditions



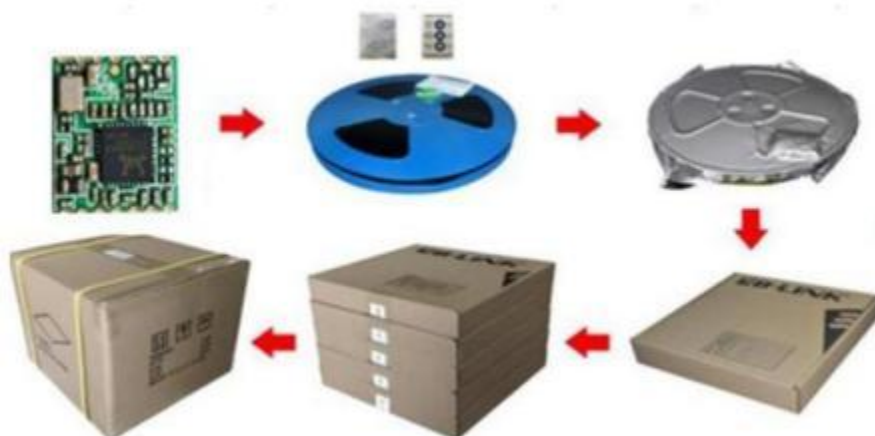
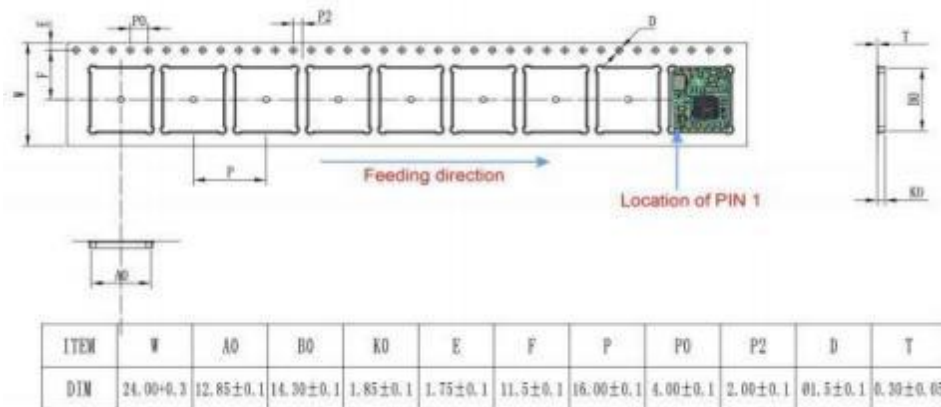
Please use the reflow within 2 times.  
Set up the highest temperature within 250°C.

## 7. Key Components Of Module

No.	Parts	Specification	Manufacturer	Note
1	Chipset	RTL8189ETV-CG	Realtek Semiconductor Corp	
2	PCB	BL-R8189RM2	Shenzhen Tie Fa Technology Limited	
			Guangdong KINGSHINE ELECTRONICS CO.,LTD	
			Quzhou Sunlord Electronics Co.,Ltd	
3	Crystal	40MHz-3225	HUBEI TKD CRYSTAL ELECTRONIC SCIENCE AND TECHNOLOGY CO.,LTD	
			LUCKI CM ELECTRONICS CO.,LTD	

## 8. Package and Storage Information

### 8.1 Package Dimensions



Package specification:

1. 2000 modules per roll and 10,000 modules per box.
2. Outer box size: 37.5\*36\*29cm.
3. The diameter of the blue environment-friendly rubber plate is 13 inches, with a total thickness of 28mm (with a width of 24mm carrying belt).
4. Put 1 package of dry agent (20g) and humidity card in each anti-static vacuum bag.
5. Each carton is packed with 5 boxes.

## 8.2 Storage Conditions

Absolute Maximum Ratings:

Storage temperature: -40°C to +85°C

Storage humidity: 10% to 95% RH ( Non-Condensing)

Recommended Storage Conditions:

Storage temperature: 5°C to +40°C

Storage humidity: 20% to 90% RH

Please use this Module within 12month after vacuum-packaged.

The Module shall be stored without opening the packing.

After the packing opened, the Module shall be used within 72hours.

When the color of the humidity indicator in the packing changed, the Module shall be baked before soldering.

Baking condition: 60°C, 24hours, 1time.

ESD Sensitivity:

ESD Protection: 2KV(HBM ,Maximum rating)

The Module is a static-sensitive electronic device.

Do not operate or store near strong electrostatic fields.

Take proper ESD precautions!



**ESD CAUTION**

## **Integration installation instruction**

### **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.<sup>3</sup>

**Explanation:** This module meets the requirements of FCC part 15C ( 15 .247) . it Specifically identified AC Power Line Conducted Emission,Radiated Spurious emissions,Band edge and RF Conducted Spurious Emissions,Conducted Peak Output Power,Bandwidth ,Power Spectral Density,Antenna Requirement.

### **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.

**Explanation:**This module is mainly used in televisions, mobile displays, and Set-top Boxes. After installing this module, the device can communicate with the smart router or smart device through WLAN, and can access the internet or watch network video programs by connecting to WLAN; Use the app through smart devices and voice commands to control your device.

This module is installed on the device motherboard. 1 , The installation requirement is SMT mount. 2, and the distance between the antenna and the human body is greater than 20cm.

This module is limited used antenna as below:

Product Name	2.4GHz FPCB antenna
Frequency	2400~2500MHz
Modulation support	WLAN/BT/ZIGBEE
VSWR	$\leq 2$
Return loss	$\leq -8\text{dB}$
Radiation	Omni-directional
Gain (peak)	2.0dBi
Polarization	Linear
Admitted Power	2W
Connector	IPEX1
Efficiency	40%~70%
Cable	RF $\Phi 1.13$ cable and length is 183 mm

## 2.4 Limited module procedures

In accordance with 47CFR 15.212 Modular Transmitters and KDB 996369 D01  
' Module Equip Auth Guide v02' . **FCC ID:2AL6KBL-R8189RM2**

**cannot meet the integrated antenna and do not contain power supply regulation on the module.**

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 single module. the module without antenna and the module was not tested in stand-alone configuration – it was tested in the Host. The modules are only used by applicants to install into the host products. The module don't have a RF shielding

### **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.

The WFCO smart power control system gives the user control of devices throughout the RV, ranging from lights, to the water pump, to the awnings and slide outs. Whether using the APP through a smart device or using voice commands, the end user has complete control of their RV. The device is installed in the RV entrance, as shown in the drawing location 1.



The module is installed in the Power Pro Control System position 1 in the following figure. The installation requirement is SMT mount. The antenna is in the picture position 2, and the distance between the antenna and the human body is greater than 20cm. Modules are only used by applicants to install into our own products.





## 2.5 Trace antenna designs

If trace antenna designs are applicable, full-detail design specifications are required per D02 Module Q&A Question 11.

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: not applicable.**

## **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 is mainly used in televisions, mobile displays, and Set-top Boxes. After installing this module, the device can communicate with the smart router or smart device through WLAN, and can access the internet or watch network video programs by connecting to WLAN; Use the app through smart devices and voice commands to control your device.

This module is installed on the device motherboard. 1, The installation requirement is SMT mount. 2, and the distance between the antenna and the human body is greater than 20cm. The device is only used indoors.

## 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:

This module is limited used antenna as below:

Product Name	2.4GHz FPCB antenna
Frequency	2400~2500MHz
Modulation support	WLAN/BT/ZIGBEE
VSWR	$\leq 2$
Return loss	$\leq -8\text{dB}$
Radiation	Omn-directional
Gain (peak)	2.0dBi
Polarization	Linear
Admitted Power	2W
Connector	IPEX1
Efficiency	40%~70%
Cable	RF $\Phi$ 1.13 cable and length is 183 mm

## **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: 2AL6KBL-R8189RM2

## **2.9 Information on test modes and additional testing requirements**

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:**

It 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 grantee is responsible for compliance to any other FCC rules and notice that the final host should be required part 15 subpart B testing when the modular transmitter installed, when it also contains unintentional-radiator digital circuitry.

**OEM integration instructions:**

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

The transmitter module may not be co-located with any other transmitter or antenna. The module shall be only used with the external antenna(s) that has been originally tested and certified with this module.

As long as the 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.).

**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 .

**End product labeling:**

The final end product must be labeled in a visible area with the following: "Contains Transmitter Module [FCC ID:2AL6KBL-R8189RM2](#)".

**warning:**

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:  
To assure continued compliance, any changes or modifications not expressly approved by the party Responsible for compliance could void the user's authority to operate this equipment. (Example- use only shielded interface cables when connecting to computer or peripheral devices). This equipment 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. FCC Radiation Exposure Statement: The equipment complies with FCC Radiation exposure limits set forth for uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.