Product Specification

IEEE 802.11b/g/n 1T1R SDIO WiFi Module

Project Name	RTL8189ES 11n WIFI Module
Model NO	F89ESSM23-W1

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0. Revision History

REV NO	Date	Modifications	Draft	Approved
Rev1.0	May 11th,2012	Page 3/14		XJ Hu
Rev1.1	Dec 30th,2013			SJ LI

1. Introduction

F89ESSM23 is a highly integrated and excellent performance Wireless LAN (WLAN) SDIO network interface device. High-speed wireless connection up to 150 Mbps .

1.1 Overview
The general hardware for the module is shown in Figure 1. This WLAN Module design is based on Realtek RTL8189ES. It is a highly integrated single-chip 1*1 MIMO (Multiple In Multiple Out) Wireless LAN (WLAN) SDIO network interface controller complying with the 802.11n specification. It combines a MAC, a 1T1R capable baseband, and RF in a single chip. It is designed to provide excellent performance with low power Consumption and enhance the advantages of robust system and cost-effective.
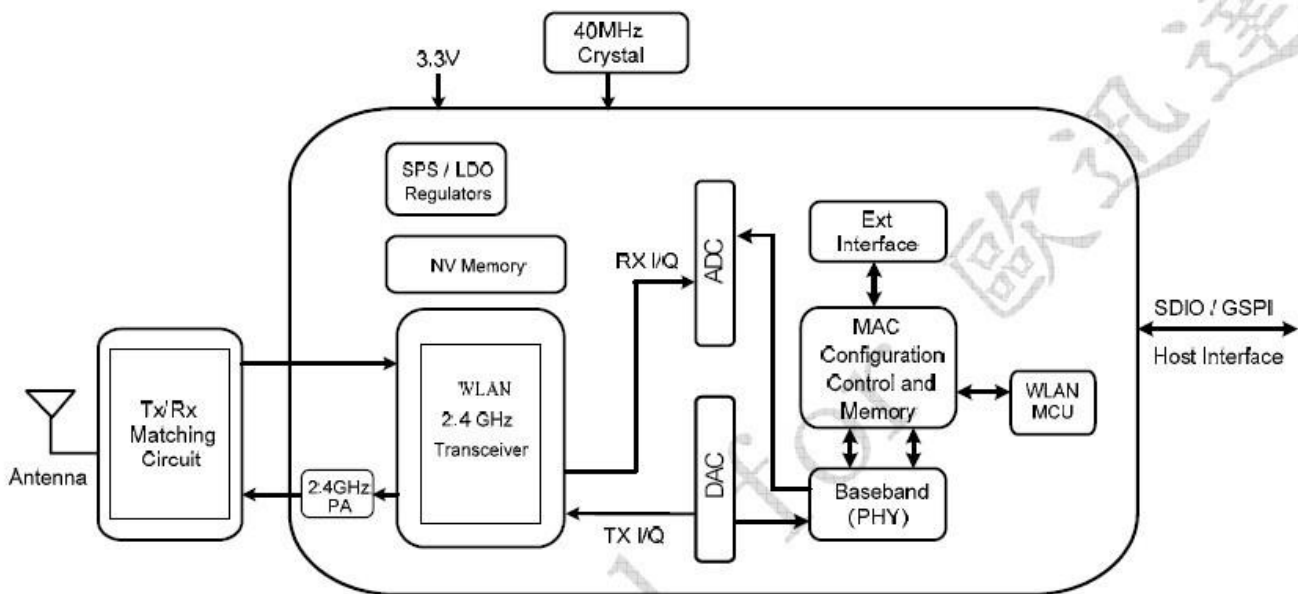
Figure 1: Single-brand 11n (1*1) solution

1.2 Specification Reference

This specification is based on additional references listed as below.
iEEE 802.11b
iEEE 802.11g
iEEE 802.11n

1.3 System Characteristics

Main Chipset	Realtek RTL8189ES
Operating Frequency	2.412～2.462GHz
WIFI Standard	Ieee802.11b/g/n 1*1
Modulation	802.11b: CCK(11, 5.5Mbps), QPSK(2Mbps), BPSK(1Mbps) 802.11 g/n: OFDM
PHY Data rates	802.11b: 11,5.5,2,1 Mbps 802.11g: 54,48,36,24,18,12,9,6 Mbps 802.11n: up to 150Mbps
Receiver Sensitivity	130M：-70dBm@10% PER; 108M：-70dBm@10% PER; 54M：-70dBm@10% PER; 11M：-87dBm@8% PER; 6M：-90dBm@10% PER; 1M：-92dBm@8% PER
Host Interface	SDIO/GSPI
Operation Range	Up to 150meters in open space
RF Power	<9.0dBm@11n,<9.8dBm@11b,<9.5dBm@11g
RF Antenna	Integral Antenna (0dBi gain)
OS Support	Android / Win CE /iOS /Linux/Windows 2000/XP/Vista/WIN7
Security	WEP,TKIP,AES,WPA,WPA2
Power Consumption	3.3Vdc 110mA Max
Operating Temperature	-20~ +45°C Ambient Temperature
Storage Temperature	-40~ +70°C Ambient Temperature
Humidity	5% to 90% maximum (non-condensing)
Dimension	Typical L14.00*W12.50*T2.00mm

2. Mechanical Specification
2.1 Outline Drawing
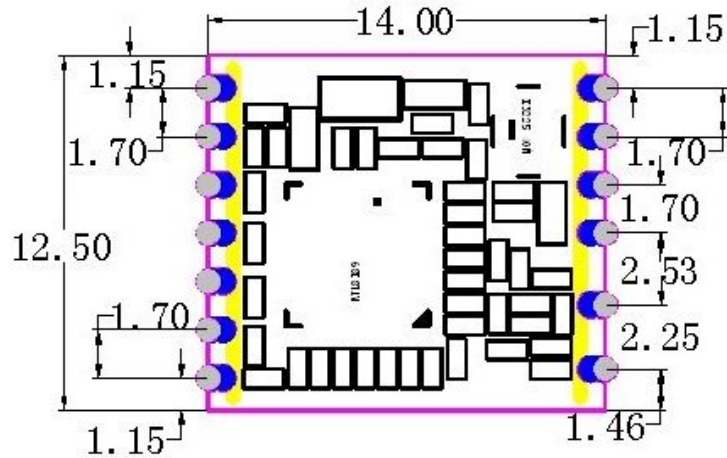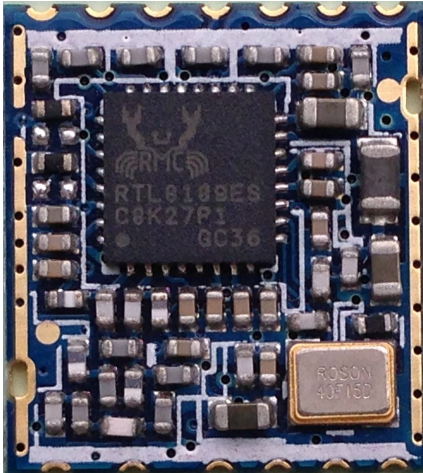
2.2 Connector Pin Definition
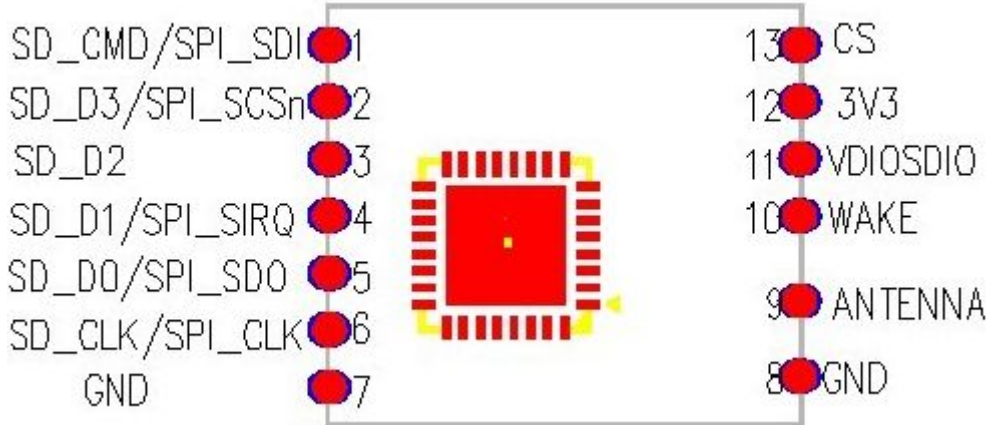
Pin #	Name	Description
1	SD_CMD	SDIO Command Input
2	SD_D3	SDIO Data Line 3
3	SD_D2	SDIO Data Line 2
4	SD_D1	SDIO Data Line 1
5	SD_D0	SDIO Data Line 0
6	SD_CLK	SDIO Clock Input
7	GND	POWER GND
8	GND	POWER GND
9	ANTENNA	RF OUT
10	WAKE	Wake Function
11	VDIOSDIO	SDIO Voltage 1.8V-3.3V

12	3.3	Power Supply
13	CS	PDn

2.3 Layout reference
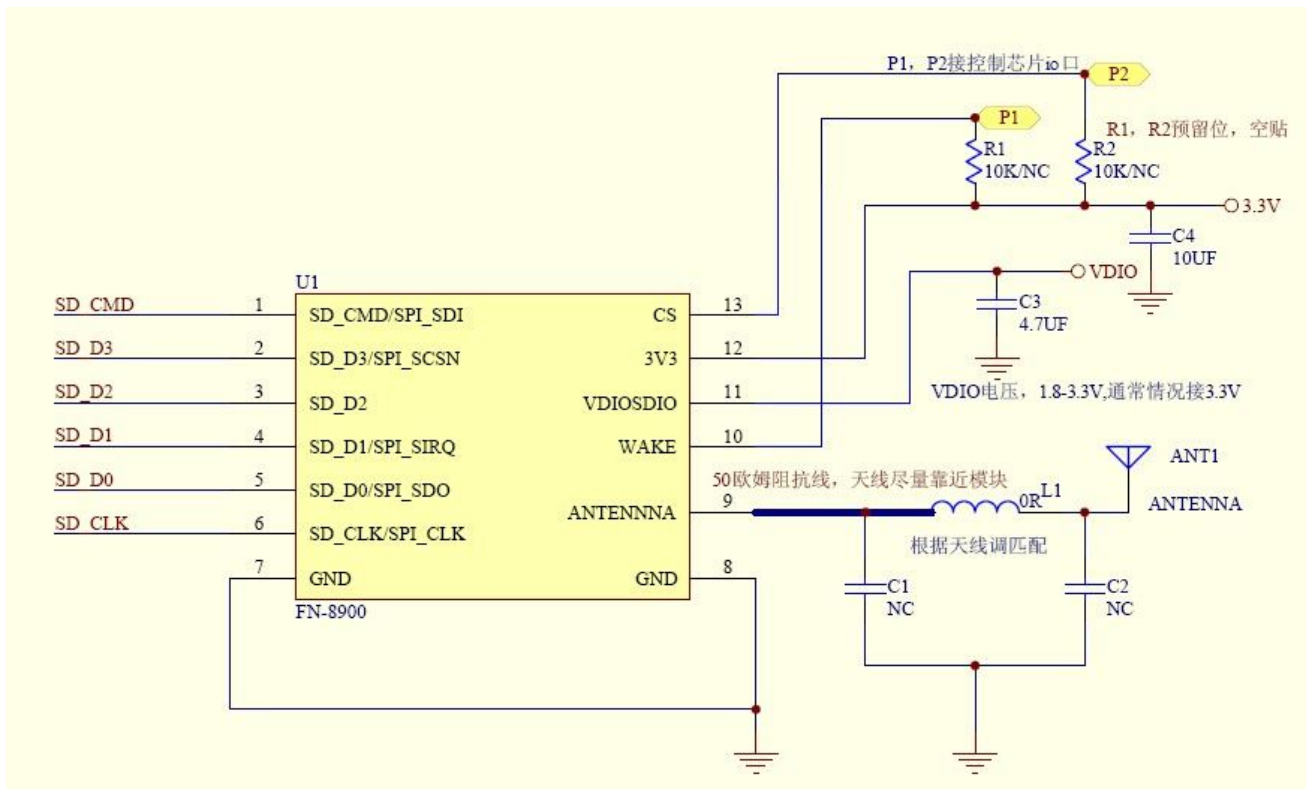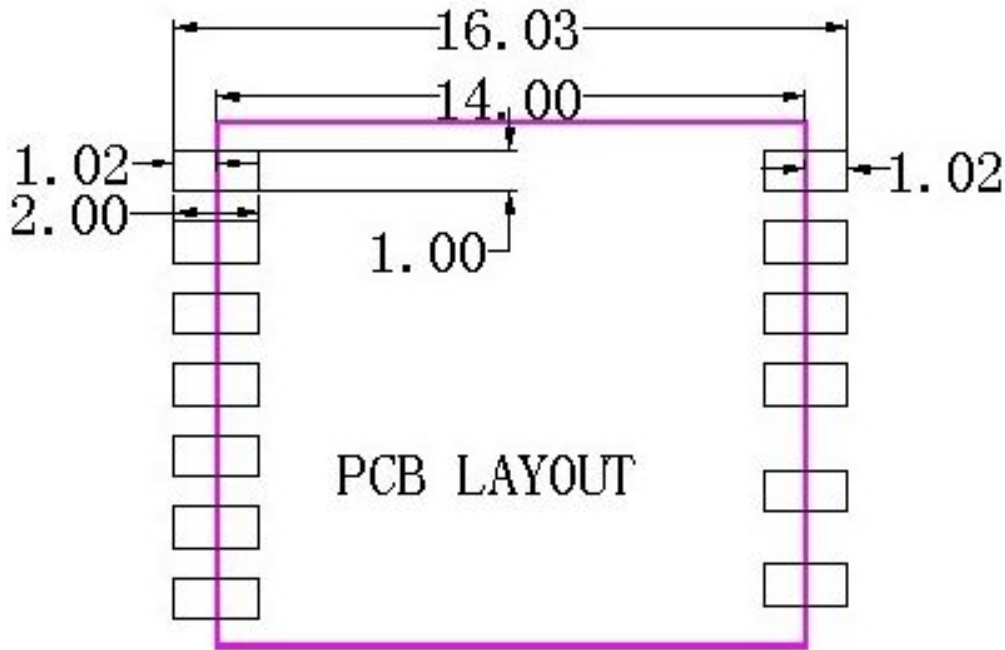
3. **RF Performance**

3.1 Transmitter Power (Unit in dBm) (Typical 1,6,11 Channel)

11n 20MHz Mode （Spec<9dBm）

Mode	Rate	Channel 1	Channel 6	Channel 11
11n 20MHz	MCS0	8.5	8.3	8.4
	MCS3	8.3	8.4	8.3
	MCS5	8.5	8.2	8.5
	MCS7	8.3	8.5	8.4

11n 40MHz Mode （Spec<9dBm）

Mode	Rate	Channel 1	Channel 6	Channel 11
11n 40MHz	MCS0	7.6	7.4	7.3
	MCS3	7.5	7.2	7.4
	MCS5	7.3	7.5	7.6
	MCS7	7.5	7.2	7.3

3.2 EVM

11b Mode: unit in % （Spec≦10%）

Mode	Rate	Channel 1	Channel 6	Channel 11
11b CCK	1Mbps	5.2	5.3	5.5
	2Mbps	5.4	5.3	5.5
	5.5Mbps	5.6	5.3	5.5
	11Mbps	5.9	5.6	5.9

11g Mode: unit in dB （Spec≦-25dB）

Mode	Rate	Channel 1	Channel 6	Channel 11
11g OFDM	6Mbps	-29.3	-29.5	-29.1
	18Mbps	-29.2	-28.5	-29.3
	36Mbps	-28.5	-28.9	-28.1
	54Mbps	-29.8	-29.1	-29.0

11n 20MHz Mode: unit in dB（Spec≦-25dB）

Mode	Rate	Channel 1	Channel 6	Channel 11
11n 20MHz	MCS0	-28.3	-28.5	-28.5
	MCS3	-28.2	-29.5	-28.4
	MCS5	-28.3	-28.5	-28.1
	MCS7	-28.1	-28.4	-28.0

11n 40MHz Mode: unit in dB （Spec≦-25dB）

Mode	Rate	Channel 1	Channel 6	Channel 11
11n 40MHz	MCS0	-27.3	-27.5	-26.5
	MCS3	-27.2	-26.5	-26.4
	MCS5	-27.3	-26.5	-26.1
	MCS7	-28.3	-28.2	-28.1

3.3 Transmit Center Frequency Tolerance

11g transmit center frequency tolerance test result:

Channel	CH6
Result(ppm)	0.65
Frequency tolerance	1.57KHz
Pass/Fail	PASS

11n transmit center frequency tolerance test result:

Channel	CH6
Result(ppm)	0.71
Frequency tolerance	1.73KHz
Pass/Fail	PASS

3.4 Receiver sensitivity (Unit in dBm)

11b Mode: 1RX （Spec≦-75dBm）

Mode	Rate	Channel 1	Channel 6	Channel 11
11b	1Mbps	-90	-90	-90
	2Mbps	-90	-90	-91
	5.5Mbps	-89	-89	-88
	11Mbps	-85	-85	-86

11g Mode: 1RX （Spec≦-65dBm）

Mode	Rate	Channel 1	Channel 6	Channel 11
11g	6Mbps	-90	-90	-90
	9Mbps	-90	-90	-91
	12Mbps	-89	-89	-88
	18Mbps	-85	-85	-86
	24Mbps	-78	-79	-78
	36Mbps	-75	-75	-75
	48Mbps	-71	-71	-71
	54Mbps	-69	-68	-70

11n 20MHz Mode: 1RX （Spec≦-65dBm）

Mode	Rate	Channel 1	Channel 6	Channel 11
11n 20MHz	MCS0	-85	-85	-85
	MCS1	-82	-82	-82
	MCS2	-80	-80	-80

	MCS3	-77	-77	-77
	MCS4	-73	-74	-74
	MCS5	-69	-70	-69
	MCS6	-68	-68	-68
	MCS7	-66	-66	-66

11n 40MHz Mode: 1RX 　（Spec≦-60dBm）

Mode	Rate	Channel 1	Channel 6	Channel 11
11n 40MHz	MCS0	-83	-83	-83
	MCS1	-79	-80	-80
	MCS2	-77	-77	-77
	MCS3	-74	-75	-75
	MCS4	-71	-71	-71
	MCS5	-67	-67	-67
	MCS6	-65	-65	-65
	MCS7	-63	-63	-63

3.5 Power Consumption

Mode	Status	Power(mW)	Note
OS Windows XP	Link	3.3Vx70mA =231	20M
		3.3Vx75 mA =248	40M
	RX	3.3Vx75mA =248	20M
		3.3Vx75 mA =248	40M
	TX	3.3Vx100 mA =330	20M
		3.3Vx110 mA=363	40M
	Power save mode	3.3Vx20 mA =66	DTIM=100ms
	Device Disable	3.3Vx25 mA =82.5	
	Radio Off	3.3Vx0 mA =0	

4.0 Package

4.1 blister packaging

Remark: 100pcs/Layer, 10Layer/Bag, 1,000pcs/Bag

4.2 the roll package
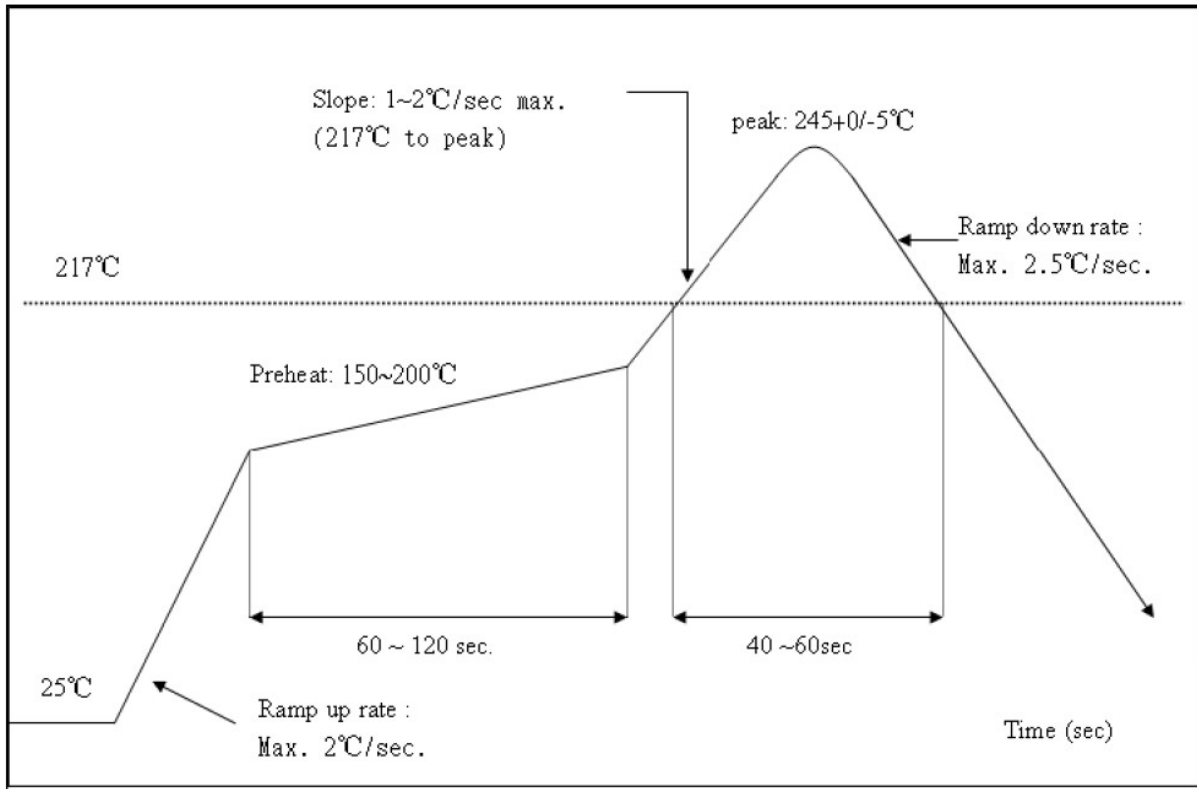

2,000pcs/roll

5.0 User's Manual
5.1 Recommended Reflow curve
Referred to IPC/JEDEC standard
Peak Temperature : <250°C
Number of Times : ≤2 times

5.2 Patch WIFI modules installed before the notice:

WIFI module installed note:
1. Please press 1 : 1 and then expand outward proportion to 0.7 mm, 0.12 mm thickness When open a stencil
2. Take and use the WIFI module, please insure the electrostatic protective measures.
3. Reflow soldering temperature should be according to the customer the main size of the products, such as the temperature set at 250 + 5 ℃ for the MID motherboard.

About the module packaging, storage and use of matters needing attention are as follows:
1. The module of the reel and storage life of vacuum packing: 1). Shelf life: 8 months, storage environment conditions: temperature in: < 40 ℃, relative humidity: < 90% r.h.
2. The module vacuum packing once opened, time limit of the assembly:
Card: 1) check the humidity display value should be less than 30% (in blue), such as: 30% ~ 40% (pink), or greater than 40% (red) the module have been moisture absorption.
2.) factory environmental temperature humidity control: ≦ 30% ℃, ≦ 60% r.h..
3). Once opened, the workshop the preservation of life for 168 hours.
3. Once opened, such as when not used up within 168 hours:
1). The module must be again to remove the module moisture absorption.
2). The baking temperature: 125 ℃, 8 hours.
3.) after baking, put the right amount of desiccant to seal packages.

FCC ID: 2AATL-F89ESSM23

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.

FCC Caution: Any 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.

IMPORTANT NOTE:
This device is intended only for OEM integrators under the following conditions:
(1) According to FCC Part 15 Subpart C Section 15.212, the radio elements of the modular transmitter must have their own shielding. However, due to there is no shielding for this WIFI Module, this module is granted as a Limited Modular Approval.
(2) This module has been designed to operate with a Integral antenna having a maximum gain of 0dBi. Only this type of antenna may be used.
(3) Integration is typically strictly restricted to Grantee himself or dedicated OEM integrators under control of the Grantee.
As long as 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.).

IMPORTANT NOTE:
In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter).then the FCC authorization is no longer considered valid and the FCC ID can not 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.

IMPORTANT NOTE:
This module is intended for OEM integrator only and the OEM integrators are instructed to ensure that the end user has no manual instructions to remove or install the device. The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module.

LABEL OF THE END PRODUCT:
The final end product must be labeled in a visible area with the following "Contains TX FCC ID: 2AATL-F89ESSM23". 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.

We hereby requests for part 15 unlicensed limited modular transmitter approval of our device, described as follows:
This RF Module does not have an own shielding, so that a Limited Modular Approval (LMA) was granted: This RF module is strictly limited to the integration by the Grantee himself or the dedicated OEM

integrators under the control of the Grantee.

Proper measurements of the host device including this RF module (radiated spurious emissions and bandedge) are required to assure compliance with the FCC regulations.