

AW-NM191NF

IEEE 802.11b/g/n Wireless LAN Module (M.2 1216) (Industrial version)

Datasheet

Version 0.1

Revision History

Document release	Date	Modification	Initials	Approved
Version 0.1	2019/4/2	Initial version	Josh Lin	Patrick Lin

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Table of Contents

1. GENERAL DESCRIPTION	4
2. KEY FEATURES	5
3. SPECIFICATIONS TABLE	6
4. ELECTRICAL CHARACTERISTICS.....	8
4.1 ABSOLUTE MAXIMUM RATINGS	8
4.2 RECOMMENDED OPERATING CONDITIONS	8
4.3 POWER UP SEQUENCE.....	8
4.4 SDIO HOST INTERFACE SPECIFICATIONS	9
5. PIN DEFINITION.....	11
5.1 PIN DESCRIPTION (1216 M.2 SOLDER DOWN).....	11
6. MECHANICAL INFORMATION	15
7. FCC STATEMENT.....	16

1. General Description

AzureWave Technologies, Inc. introduces the pioneer of the IEEE 802.11 b/g/n WIFI M.2 module --- **AW-NM191NF**. The AW-NM191NF IEEE 802.11 b/g/n WIFI M.2 module is a highly integrated wireless local area network (WLAN) solution to let users enjoy the digital content through the latest wireless technology without using the extra cables and cords. It enables a **high performance, cost effective, low power, compact solution** that provides SDIO or USB interface to host processor.

Compliance with the IEEE 802.11b/g/n standard, the AW-NM191NF uses Direct Sequence Spread Spectrum (**DSSS**), Orthogonal Frequency Division Multiplexing (**OFDM**), **DBPSK**, **DQPSK**, **CCK** and **QAM** baseband modulation technologies. A high level of integration and full implementation of the power management functions specified in the IEEE 802.11 standard minimize the system power requirements by using AW-NH387L. In addition to the support of **WPA/WPA2** and **WEP** 64-bit and 128-bit encryption, the AW-NH387L also supports the **IEEE 802.11i** security standard through the implementation of **Advanced Encryption Standard (AES)/Counter Mode CBC-MAC Protocol (CCMP)**, Wired Equivalent Privacy (**WEP**) with Temporal Key Integrity Protocol (**TKIP**), Advanced Encryption Standard (**AES**)/Cipher-Based Message Authentication Code (**CMAC**), and WLAN Authentication and Privacy Infrastructure (**WAPI**) security mechanisms. For the video, voice and multimedia applications the AW-NH387L support **802.11e Quality of Service (QoS)**.

A high level of integration and full implementation of the power management functions specified in the IEEE 802.11 standard minimize system power requirements by using **AW-NM191NF**.

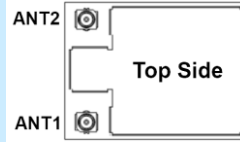
AW-NM191NF module adopts Marvell 88W8801 solution.

2. Key Features

1. High speed wireless connection up to 72.2 Mbps for Wi-Fi
2. 2 antennas to support 1(Transmit) × 1(Receive) diversity technology
3. Low power consumption and high performance
4. Enhanced wireless security
5. USB 2.0 device interface with LPM support
6. SDIO 2.0 device interface (1-bit SDIO, 4-bit SDIO transfer modes at full clock range up to 50 MHz)

Note: This module supports both USB and SDIO interfaces, but default setting is USB interface. To bring up SDIO interface, one extra 10K resistor is needed to pull low.

3. Specifications Table

Model Name	AW-NM191NF		
Product Description	Wireless LAN M.2 Module		
WLAN Standard	IEEE 802.11b/g/n, Wi-Fi compliant		
Major Chipset	Marvell 88W8801		
Host Interface	WLAN : SDIO/USB		
Antenna	ANT2: WIFI-TX/RX		
	ANT1: WIFI-TX/RX		
Dimensions	12 mm X 16 mm x 1.95 mm		
Weight	TBA		
Operating Conditions			
Voltage	3.3V+-10%		
Temperature	Operating: -40 ~ 85°C Storage: -40 ~ 85°C		
Humidity	Operating: <95% (non condensing) ; Storage: <95% (non condensing)		
Electrical Specifications			
Frequency Range	2.4 GHz ISM Bands: 2.412-2.472 GHz, 2.484 GHz		
Number of Channels	● 802.11b: USA, Canada and Taiwan 1– 11 ■ Most European Countries 1– 13 ■ Japan 1– 14 ● 802.11g: USA and Canada 1– 11 ■ Most European Countries 1– 13 ● 802.11n(2.4G): North America 1– 11 ■ Most European Countries 1– 13		
Modulation	● 802.11g/n: OFDM ● 802.11b: CCK(11, 5.5Mbps), DQPSK(2Mbps), BPSK(1Mbps)		
Output Power	● 802.11b: 17+/-1.5dBm (11Mbps) ● 802.11g: 14+/-1.5dBm (54Mbps) ● 802.11n @2.4GHz: 13 +/-1.5dBm (HT20 MCS7)		
Receive Sensitivity	● 802.11b: less than -76 dBm (11Mbps) ● 802.11g: less than -65 dBm (54Mbps) ● 802.11n: less than -64 dBm at HT20 MCS7		
Data Rates	● 802.11b: 1, 2, 5.5, 11Mbps ● 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps ● 802.11n: up to 72.2Mbps		
Security	● WPA™- and WPA2™- (Personal) support for powerful encryption and authentication ● AES and TKIP acceleration hardware for faster data encryption and 802.11i compatibility		

	● Secure Easy Setup™ for simple Wi-Fi® setup and WPA2/WPA security configuration ● Wi-Fi Protected Setup (WPS) ● WEP ● WMM / WMM-SA ● CKIP(Software)
ESD test condition	● HBM +-2KV ● CDM +-500V
Operating System Compatibility	TBA
Regulatory	CE and FCC

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4. Electrical Characteristics

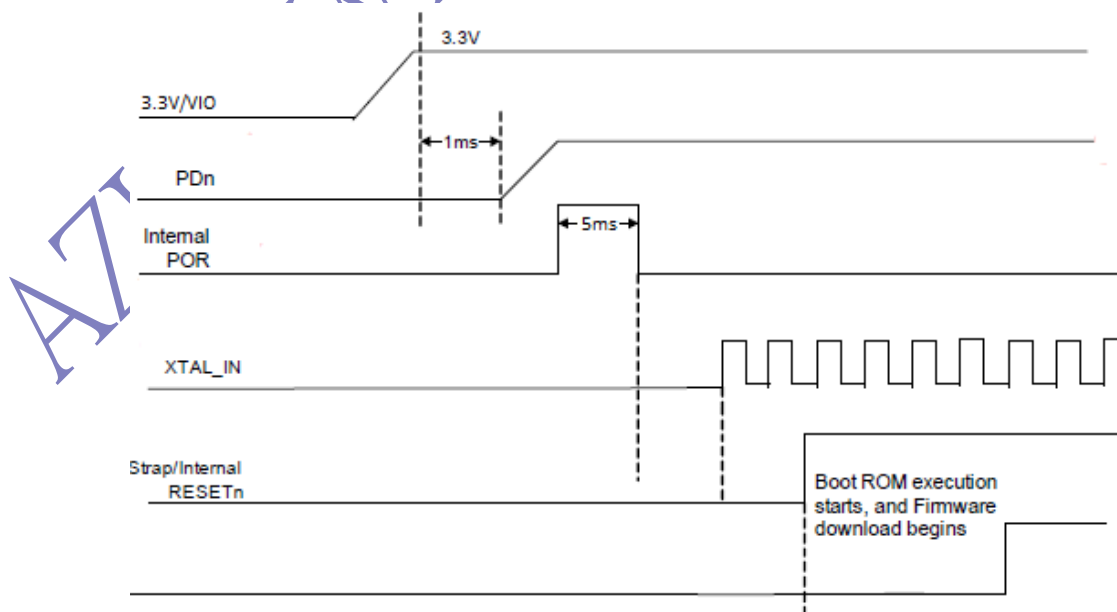
4.1 Absolute Maximum Ratings

Symbol	Parameter	Min	Typ	Max	Units
VIO	1.8V/3.3V digital I/O power supply	-	1.8	2.2	V
		-	3.3	4.0	
VIO_SD	1.8V/3.3V digital I/O SDIO power supply	-	1.8	2.2	V
		-	3.3	4.0	
3.3V	3.3V I/O power supply	-	3.3	4.0	V

4.2 Recommended Operating Conditions

Symbol	Parameter	Min	Typ	Max	Units
VIO	1.8V/3.3V digital I/O power supply	1.62	1.8	1.98	V
		2.97	3.3	3.63	
VIO_SD	1.8V/3.3V digital I/O SDIO power supply	1.62	1.8	1.98	V
		2.97	3.3	3.63	
3.3V	3.3V I/O power supply	2.97	3.3	3.63	V

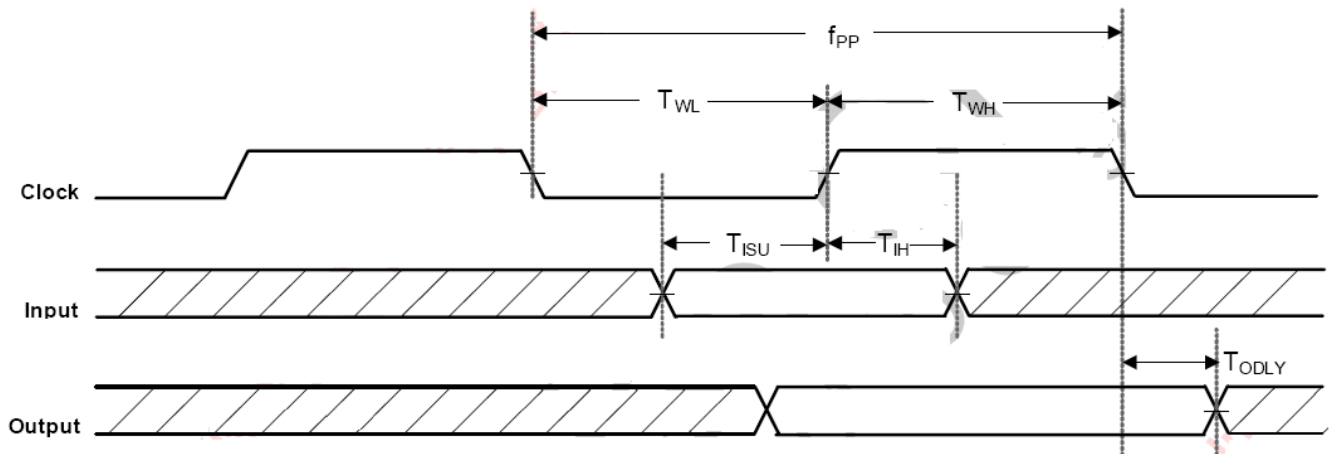
4.3 Power up sequence



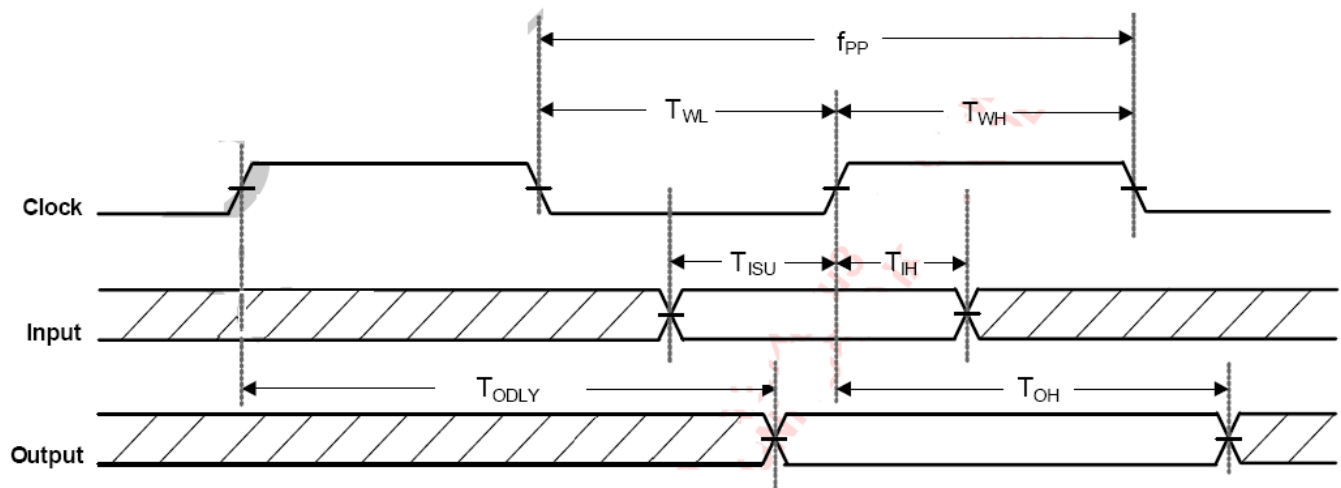
4.4 SDIO Host Interface Specifications

Referred from Marvell hardware specifications

SDIO Protocol Timing Diagram



SDIO Protocol Timing Diagram—High Speed Mode



SDIO Timing Data

Symbol	Parameter	Condition	Min	Typ	Max	Units
f_{pp}	CLK Frequency	Normal	0	-	25	MHz
		High Speed	0		75	
T_{WH}	CLK High Time	Normal	10	-	-	ns
		High Speed	7		-	
T_{WL}	CLK Low Time	Normal	10	-	-	
		High Speed	7		-	
T_{ISU}	Input Setup Time	Normal	5	-	-	
		High Speed	6		-	
T_{IH}	Input Hold Time	Normal	5	-	-	
		High Speed	2		-	
T_{ODLY}	Output Delay Time	-	0	-	7.33	
T_{OH}	Output Hold Time	High Speed	2.5	-	-	

5. Pin Definition

5.1 Pin Description (1216 M.2 Solder down)

PIN No.	Definition	Description	Type	Voltage Level
1	TMS	JTAG controller select (input)	Input	VIO
2	TCK	JTAG test clock (input)	Input	VIO
3	TDI	JTAG test data (input)	Input	VIO
4	3.3V	3.3V Power supply.	VCC	-
5	3.3V	3.3V Power supply.	VCC	-
6	GND	Ground.	GND	-
7	TDO	JTAG test data (output)	Input	VIO
8	NC	No connect to gold fingers.	Floating	-
9	NC	No connect to gold fingers.	Floating	-
10	NC	No connect to gold fingers.	Floating	-
11	NC	No connect to gold fingers.	Floating	-
12	NC	No connect to gold fingers.	Floating	-
13	NC	No connect to gold fingers.	Floating	-
14	NC	No connect to gold fingers.	Floating	-
15	NC	No connect to gold fingers.	Floating	-
16	NC	No connect to gold fingers.	Floating	-
17	GND	Ground.	GND	-
18	NC	No connect to gold fingers.	Floating	-
19	NC	No connect to gold fingers.	Floating	-
20	GND	Ground.	GND	-
21	CON[0]	Boot Options and Host Interface Selection 00 = UART (debug) 01 = reserved 10 = SDIO (CON1=>HIGH ,CON0=>Low) 11 = USB (default)	Input	1.8V
22	CON[1]		Input	1.8V
23	GND	Ground.	GND	-
24	NC	No connect to gold fingers.	Floating	-
25	NC	No connect to gold fingers.	Floating	-
26	GND	Ground.	GND	-
27	NC	No connect to gold fingers.	output	-
28	NC	No connect to gold fingers.	Floating	-

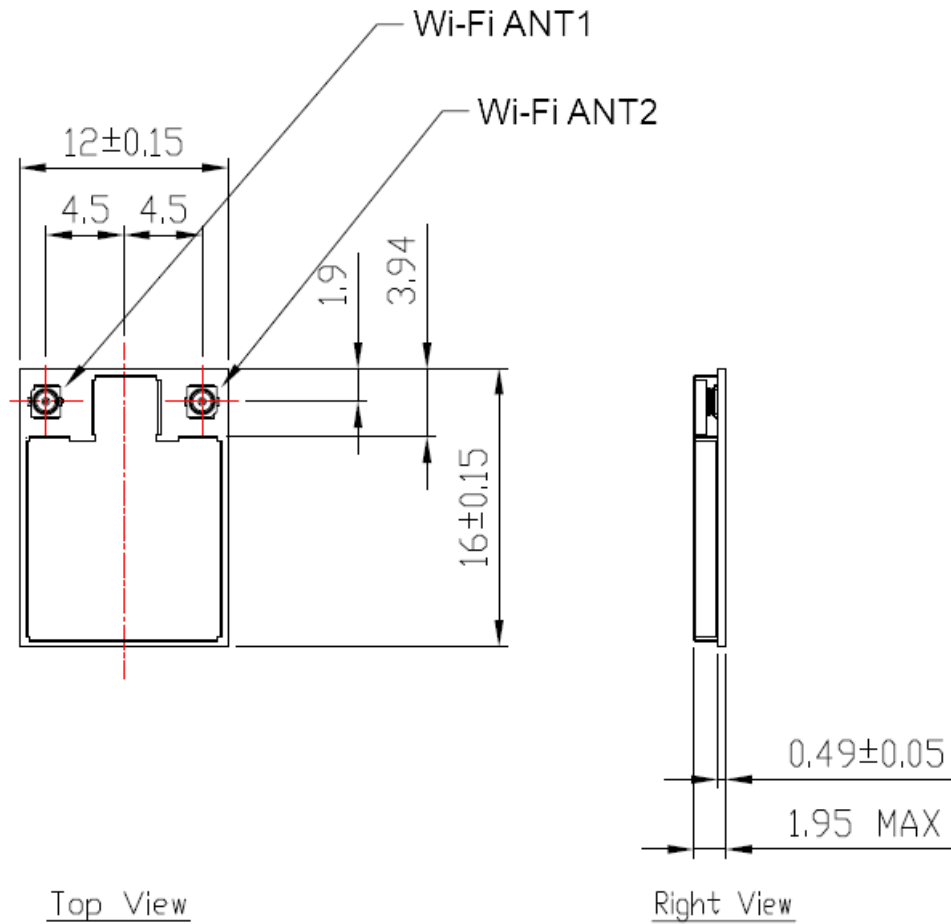
29	NC	No connect to gold fingers.	Floating	-
30	NC	No connect to gold fingers.	Floating	-
31	NC	No connect to gold fingers.	Floating	-
32	GND	Ground.	GND	-
33	NC	No connect to gold fingers.	Floating	-
34	NC	No connect to gold fingers.	Floating	-
35	GND	Ground.	GND	-
36	NC	No connect to gold fingers.	Floating	-
37	NC	No connect to gold fingers.	Floating	-
38	GND	Ground.	GND	-
39	NC	No connect to gold fingers.	Floating	-
40	NC	No connect to gold fingers.	Floating	-
41	GND	Ground.	GND	-
42	GPIO0	GPIO	Input/Output	VIO
43	HOST_WAKE	Host-to-SoC Wakeup (input)	input	1.8V
44	SD_VIO	I/O SDIO Power Supply	VCC	-
45	PDN	Full Power-Down (active low) 0 = full power-down mode 1 = normal mode • Connect to power-down pin of host or 3.3V • External host required to drive this pin high for normal operation • No internal pull-up on this pin.	VCC	3.3V/1.8V
46	GPIO1	GPIO	Input/Output	VIO
47	SDIO DAT3	SDIO 4-bit Mode: Data line Bit[3] SDIO 1-bit Mode: Reserved SDIO SPI Mode: Card select (active low)	Input/Output	SD_VIO
48	SDIO DAT2	SDIO 4-bit Mode: Data line Bit[2] or read wait (optional) SDIO 1-bit Mode: Read wait (optional) SDIO SPI Mode: Reserved	Input/Output	SD_VIO
49	SDIO DAT1	SDIO 4-bit Mode: Data line Bit[1] SDIO 1-bit Mode: Interrupt SDIO SPI Mode: Interrupt SDO is tristate when SCSn is inactive. Enables multiple devices driving SDO line.	Input/Output	SD_VIO
50	SDIO DAT0	SDIO 4-bit Mode: Data line Bit[0] SDIO 1-bit Mode: Data line SDIO SPI Mode: Data output	Input/Output	SD_VIO
51	SDIO CMD	SDIO 4-bit Mode: Command/response (input/output) SDIO 1-bit Mode: Command line SDIO SPI Mode: Data input USB Mode: USB_VBUS_ON (input)	Input/Output	SD_VIO
52	SDIO CLK	SDIO 4-bit Mode: Clock input SDIO 1-bit Mode: Clock input SDIO SPI Mode: Clock input	Input	SD_VIO
53	NC	No connect to gold fingers.	Floating	-

54	NC	No connect to gold fingers.	Floating	-
55	NC	No connect to gold fingers.	Floating	-
56	NC	No connect to gold fingers.	Floating	-
57	GND	Ground	GND	-
58	NC	No connect to gold fingers.	Floating	-
59	NC	No connect to gold fingers.	Floating	-
60	NC	No connect to gold fingers.	Floating	-
61	NC	No connect to gold fingers.	Floating	-
62	GND	Ground.	GND	-
63	NC	No connect to gold fingers.	Floating	-
64	NC	No connect to gold fingers.	Floating	-
65	NC	No connect to gold fingers.	Floating	-
66	GPIO3	GPIO	Input/Output	VIO
67	GPIO2	GPIO	Input/Output	VIO
68	GND	Ground.	GND	-
69	USB_D+	USB Serial Differential Data Positive	Input/Output	3.3V
70	USB_D-	USB Serial Differential Data Negative	Input/Output	3.3V
71	GND	Ground.	GND	-
72	3.3V	3.3V Power supply.	VCC	-
73	VIO	3.3V Power supply.	VCC	-
74	GND	Ground.	GND	-
75	GND	Ground.	GND	-
76	GND	Ground.	GND	-
77	GND	Ground.	GND	-
78	GND	Ground.	GND	-
79	GND	Ground.	GND	-
80	GND	Ground.	GND	-
81	GND	Ground.	GND	-
82	GND	Ground.	GND	-
83	GND	Ground.	GND	-
84	GND	Ground.	GND	-
85	GND	Ground.	GND	-
86	GND	Ground.	GND	-
87	GND	Ground.	GND	-
88	GND	Ground.	GND	-
89	GND	Ground.	GND	-

90	GND	Ground.	GND	-
91	GND	Ground.	GND	-
92	GND	Ground.	GND	-
93	GND	Ground.	GND	-
94	GND	Ground.	GND	-
95	GND	Ground.	GND	-
96	GND	Ground.	GND	-
G1	GND	Ground.	GND	-
G2	GND	Ground.	GND	-
G3	GND	Ground.	GND	-
G4	GND	Ground.	GND	-

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6. Mechanical Information



Tolerances unless otherwise specified : $\pm 0.15\text{mm}$

7. FCC Statement

Federal Communication Commission Interference 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.

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

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

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.

This device has been tested for compliance to FCC Part 15.247 and is intended only for OEM integrators under the following conditions:

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users.
- 2) The transmitter module may not be co-located with any other transmitter or antenna.
- 3) This transmitter module is tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B (unintentional radiator) rule requirement applicable to the final host. The final host will still need to be reassessed for compliance to this portion of rule requirements if applicable.
- 4) The following antennas have been certified for use with this module; antennas of the same type with equal or lower gain may also be used with this module.

Brand	Model	Ant. Gain (dBi) Including cable loss	Frequency range (MHz to MHz)	Antenna Type	Cnconnector Type	Cable Loss (dB)	Cable Length (cm)
MAG.LAYERS	MSA-4008-25GC1-A2	2.98 5.16	2400~2500 5150~5850	PIFA	I-PEX 4	NA	15

As long as all 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

IMPORTANT NOTE: In the event that these conditions cannot 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 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

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: TLZ-NM191NF". The grantee's FCC ID can be used only when all FCC compliance requirements are met.

Manual Information to the End User

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.