



Product External Specifications
For
802.11ac PCI Express Card

Model Number : MRLBB-1301

Revision: 1.0

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1.0 Scope

1.1 Document

This document is to specify the product requirements for **802.11ac PCI Express**. This PCI Express card is based on BCM chip that complied with IEEE 802.11ac from 5GHz, and it is also backward compatible to comply with IEEE 802.11a and IEEE 802.11n standard.

1.2 Product Features

- a) Dual band 802.11a / b / g / n/ ac radio
 - i) 3 streams 3x3 MIMO
 - ii) 2.4 / 5G operation
 - iii) 1.3Gbps data rate
- b) Miniature RF connectors
- c) PCI express mini card form factor
- d) 0 to 50 C operation
- e) ROHS complaint
- f) Low cost, highly integrated design

2.0 Requirements

The following sections identify the detailed requirements of the **802.11ac PCI Express**.

2.1 Radio Card Specifications

Specification	Description
Frequency Range	2400–2500 MHz 4900–5845 MHz Actual operating frequencies depend on regulatory approval for the country of use.
Wireless Medium	Direct Sequence Spread Spectrum (DSSS), Orthogonal Frequency Division Multiplexing (OFDM), Spatial multiplexing (MIMO)
Network Standards	802.11a, 802.11b, 802.11g, 802.11n, 802.11ac draft
Channel Bandwidth Supported	20, 40, and 80 MHz
Spatial Streams	3 (3x3 configuration) Also support 1 and 2 streams modes
Data Rates Supported	802.11b: 1, 2, 5.5, 11 Mbps 802.11g: 1, 2, 5.5, 11, 6, 9, 12, 18, 24, 36, 48, and 54 Mbps 802.11a: 6, 9, 12, 18, 24, 36, 48, and 54 Mbps 802.11n: MCS0 up to MCS23 (450 Mbps) 802.11ac: NSS1-MCS0 up to NSS3-MCS9 (1300 Mbps)
Maximum Available Conducted Transmit Power	2.4 GHz: 25.65 dBm 5 GHz: 24.90 dBm Actual transmit power may be limited by the country of operation.
Transmit Power Control	1dB step
Operating Temperature	0°C to 55°C
Non-operating/Storage Temperature	-40°C to 70°C

2.2 General Section

#	Feature	Detailed Description
2.2.1	Antenna Connector	• Three UFL compatible antenna connectors
2.2.2	Operating Voltage	• 3.3VDC +/- 5%
2.2.3	Current Consumption	• 5.1W is use on continue TX
2.2.4	Form Factor and Interface	• Mini-card form factor with signal of PCI-e Gen1 X1 lane

2.3 Software Requirements

The Configuration Software supports Linux driver. This configuration software includes the following functions:

- **Information**
Information allows you to monitor network status.
- **Configuration**
Configuration allows you to configure parameters for wireless networking.
- **Security**
Supports enhanced security WEP, 802.1x, WPA and WPA2.

2.3.1 Security

#	Feature	Detailed Description
2.3.1.1	Encryption	• RC4 encryption algorithm • Support 64-bit and 128-bit WEP encryption • Support open system (OSA) and shared key authentication (SKA)
2.3.1.2	WEP Management	• Four WEP keys can be selected • STA with WEP off will never associate any AP with WEP enabled • WEP Key Format: Option for Hex format
2.3.1.3	802.1x	• Support EAP-TLS, EAP-TTLS, and EAP-PEAP
2.3.1.4	WPA/WPA2	• Support WPA/WPA2-PSK and WPA/WPA2-EAP • Support Cipher Mode AES and TKIP

2.4 Mechanical Requirements

The mechanical dimensions of the Mapletree radio card shall conform to the base PCI Express Mini Card Electromechanical Specification Revision 2.0 section 2.2.3 for Full Mini-card.

FCC Statement:

Federal Communication Commission Interference Statement

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.

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.

For product available in the USA/Canada market, only channel 1~11 can be operated. Selection of other channels is not possible.

This device and its antenna(s) must not be co-located with any other transmitters except in accordance with FCC multi-transmitter product procedures.

Referring to the multi-transmitter policy, multiple-transmitter(s) and module(s) can be operated simultaneously without C2P.

This device is going to be operated in 5.15~5.25GHz frequency range, it is restricted in indoor environment only.

IMPORTANT NOTE:

This module is intended for OEM integrator. The OEM integrator is responsible for the compliance to all the rules that apply to the product into which this certified RF module is integrated. Additional testing and certification may be necessary when multiple modules are used.

20cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into. Under such configuration, the FCC radiation exposure limits set forth for an population/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. 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 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.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " Contains TX FCC ID: RTPMRLBB1301 ". If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of 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.

IC Statement

CAN ICES-3 (B)/NMB-3(B)

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

For product available in the USA/Canada market, only channel 1~11 can be operated. Selection of other channels is not possible.

Pour les produits disponibles aux États-Unis / Canada du marché, seul le canal 1 à 11 peuvent être exploités. Sélection d'autres canaux n'est pas possible.

This device and its antenna(s) must not be co-located with any other transmitters except in accordance with IC multi-transmitter product procedures.

Referring to the multi-transmitter policy, multiple-transmitter(s) and module(s) can be operated simultaneously without reassessment permissive change.

Cet appareil et son antenne (s) ne doit pas être co-localisés ou fonctionnement en association avec une autre antenne ou transmetteur.

Dynamic Frequency Selection (DFS) for devices operating in the bands 5250- 5350 MHz, 5470-5600 MHz and 5650-5725 MHz

Sélection dynamique de fréquences (DFS) pour les dispositifs fonctionnant dans les bandes 5250-5350 MHz, 5470-5600 MHz et 5650-5725 MHz

The device for the band 5150-5250 MHz is only for indoor usage to reduce potential for harmful interference to co-channel mobile satellite systems.

les dispositifs fonctionnant dans la bande 5150-5250 MHz sont réservés uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux.

The maximum antenna gain permitted (for devices in the bands 5250-5350 MHz and 5470-5725 MHz) to comply with the e.i.r.p. limit.

le gain maximal d'antenne permis pour les dispositifs utilisant les bandes 5250-5350 MHz et 5470-5725 MHz doit se conformer à la limite de p.i.r.e.;

Users should also be advised that high-power radars are allocated as primary users (i.e. priority users) of the bands 5250-5350 MHz and 5650-5850 MHz and that these radars could cause interference and/or damage to LE-LAN devices.

De plus, les utilisateurs devraient aussi être avisés que les utilisateurs de radars de haute puissance sont désignés utilisateurs principaux (c.-à-d., qu'ils ont la priorité) pour les bandes 5250-5350 MHz et 5650-5850 MHz et que ces radars pourraient causer du brouillage et/ou des dommages aux dispositifs LAN-EL.

IMPORTANT NOTE:**IC Radiation Exposure Statement:**

This equipment complies with IC RSS-102 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.

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

IMPORTANT NOTE:

This module is intended for OEM integrator. The OEM integrator is still responsible for the IC compliance requirement of the end product, which integrates this module.

USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the IC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. IC statement is required to be available in the users manual: This Class B digital apparatus complies with Canadian ICES-003. 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.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " Contains TX IC : 466F-MRLBB1301 ".

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

This radio transmitter (identify the device by certification number, or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (identifier le dispositif par son numéro de certification ou son numéro de modèle s'il fait partie du matériel de catégorie I) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Antenna List :

Ant	Brand	Model Name	Antenna Type	Connector	Ant Gain (dBi)		Cable Loss (dBm)		True Gain (dBi)	
					2.4G	5G	2.4G	5G	2.4G	5G
1	HP	5188-9334	Dipole Antenna	Reversed-SMA	1.8	2	0.6	1	1.2	1
2	HP	J9719A	Element Antenna	N Type	6	-	0.8	-	5.2	-
3	HP	J9720A	Omnidirectional Antenna	N Type	-	8	-	1.3	-	6.7
4	HP	J9170A	Panel Antenna	N Type	10.9	13.5	3.8	4.3	7.1	9.2
5	HP	5066-3481	PCB Antenna	I-PEX	4.94	5.74	0	0	4.94	5.74

Notice for Brazil, Aviso aos usuá rios no Brasil

Este equipamento opera em caráter secundário, isto é, não tem direito a proteção contra interferência prejudicial, mesmo de estações do mesmo tipo, e não pode causar interferência a sistemas operando em caráter primário.

Notice for Korea

기종별	사용자안내문
B급 기기< (가정용 방송통신기기)	이 기기는 가정용 (B급) 으로 전자파적합등록을 한 기기로서 주로 가정에서 사용하는 것을 목 적으로 하며, 모든 지역에서 사용할 수 있습니다
Class B (Broadcasting Communication Device for Home Use)	This device obtained EMC registration mainly for home use (Class B) and may be used in all areas.

당해 무선설비는 전파혼신 가능성이 있으므로 인명안전과 관련된 서비스는 할 수 없습니다

Notice for Taiwan

低功率電波輻射性電機管理辦法

第十二條 經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

第十四條 低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

在 5.25-5.35 兆赫頻帶內操作之無線資訊傳輸設備，限於室內使用。

FCC & IC:

Power level-antenna combination for 2400 ~ 2483.5MHz / 5725 ~ 5850MHz :

Maximum Conducted Output Power	For 2.4GHz Band: Mode 1 (Ant.1 Dipole antenna / 1.2dBi) MCS0 (20MHz): 25.47 dBm ; MCS0 (40MHz): 19.47 dBm MCS16 (20MHz): 25.65 dBm ; MCS16 (40MHz): 19.45 dBm Mode 2 (Ant.2 Element antenna / 5.2dBi) MCS0 (20MHz): 25.29 dBm ; MCS0 (40MHz): 18.58 dBm MCS16 (20MHz): 25.65 dBm ; MCS16 (40MHz): 18.62 dBm Mode 3 (Ant.4 Panel antenna / 7.1dBi) MCS0 (20MHz): 25.47 dBm ; MCS0 (40MHz): 18.77 dBm MCS16 (20MHz): 25.65 dBm ; MCS16 (40MHz): 18.97 dBm Mode 4 (Ant.5 PCB antenna / 4.94dBi) MCS0 (20MHz): 25.47 dBm ; MCS0 (40MHz): 20.83 dBm MCS16 (20MHz): 25.65 dBm ; MCS16 (40MHz): 21.09 dBm For 5GHz Band: Mode 5 (Ant.1 Dipole antenna / 1dBi) 802.11ac MCS0/Nss1 (20MHz): 24.40 dBm ; 802.11ac MCS0/Nss3 (20MHz): 24.90 dBm ; 802.11ac MCS0/Nss1 (40MHz): 23.76 dBm ; 802.11ac MCS0/Nss3 (40MHz): 24.24 dBm ; 802.11ac MCS0/Nss1 (80MHz): 21.42 dBm ; 802.11ac MCS0/Nss3 (80MHz): 22.09 dBm 802.11ac MCS0/Nss1 (40MHz): 23.76 dBm ; 802.11ac MCS0/Nss3 (40MHz): 24.24 dBm ; 802.11ac MCS0/Nss1 (80MHz): 21.42 dBm ; 802.11ac MCS0/Nss3 (80MHz): 23.04 dBm Mode 6 (Ant.3 Omnidirectional Antenna / 6.7dBi) 802.11ac MCS0/Nss1 (20MHz): 24.40 dBm ; 802.11ac MCS0/Nss3 (20MHz): 24.90 dBm ; 802.11ac MCS0/Nss1 (40MHz): 23.76 dBm ; 802.11ac MCS0/Nss3 (40MHz): 24.24 dBm ; 802.11ac MCS0/Nss1 (80MHz): 21.42 dBm ; 802.11ac MCS0/Nss3 (80MHz): 23.04 dBm Mode 7 (Ant.4 Panel Antenna / 9.2dBi) 802.11ac MCS0/Nss1 (20MHz): 24.40 dBm ; 802.11ac MCS0/Nss3 (20MHz): 24.90 dBm ; 802.11ac MCS0/Nss1 (40MHz): 23.76 dBm ; 802.11ac MCS0/Nss3 (40MHz): 24.24 dBm ; 802.11ac MCS0/Nss1 (80MHz): 21.27 dBm ; 802.11ac MCS0/Nss3 (80MHz): 21.01 dBm Mode 8 (Ant.5 PCB antenna / 5.74dBi) 802.11ac MCS0/Nss1 (20MHz): 24.40 dBm ; 802.11ac MCS0/Nss3 (20MHz): 24.90 dBm ; 802.11ac MCS0/Nss1 (40MHz): 23.76 dBm ; 802.11ac MCS0/Nss3 (40MHz): 24.24 dBm ; 802.11ac MCS0/Nss1 (80MHz): 22.20 dBm ; 802.11ac MCS0/Nss3 (80MHz): 21.81 dBm
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The following test modes were performed for all tests:

Mode 1. EUT + Antenna 1- Dipole Antenna - 2.4GHz

Mode 2. EUT + Antenna 2- Element Antenna - 2.4GHz
Mode 3. EUT + Antenna 4- Panel Antenna - 2.4GHz
Mode 4. EUT + Antenna 5- PCB Antenna - 2.4GHz
Mode 5. EUT + Antenna 1- Dipole Antenna - 5GHz
Mode 6. EUT + Antenna 3- Omnidirectional Antenna - 5GHz
Mode 7. EUT + Antenna 4- Panel Antenna - 5GHz
Mode 8. EUT + Antenna 5- PCB Antenna - 5GHz

Power level-antenna combination for 5150 ~ 5350MHz / 5470 ~ 5725MHz:

Maximum Conducted Output Power	Band 1:
	Mode 1 (Ant.1 Dipole antenna / 1dBi)
	802.11ac MCS0/Nss1 (20MHz): 16.85 dBm ;
	802.11ac MCS0/Nss3 (20MHz): 16.97 dBm ;
	802.11ac MCS0/Nss1 (40MHz): 16.92 dBm ;
	802.11ac MCS0/Nss3 (40MHz): 16.95 dBm ;
	802.11ac MCS0/Nss1 (80MHz): 15.98 dBm ;
	802.11ac MCS0/Nss3 (80MHz): 16.60 dBm
	Mode 2 (Ant.3 Omnidirectional antenna / 6.7dBi)
	802.11ac MCS0/Nss1 (20MHz): 11.67 dBm ;
	802.11ac MCS0/Nss3 (20MHz): 16.17 dBm ;
	802.11ac MCS0/Nss1 (40MHz): 14.60 dBm ;
	802.11ac MCS0/Nss3 (40MHz): 16.10 dBm ;
	802.11ac MCS0/Nss1 (80MHz): 13.71 dBm ;
	802.11ac MCS0/Nss3 (80MHz): 14.88 dBm
	Mode 3 (Ant.4 Panel antenna / 9.2dBi)
	802.11ac MCS0/Nss1 (20MHz): 9.68 dBm ;
	802.11ac MCS0/Nss3 (20MHz): 13.78 dBm ;
	802.11ac MCS0/Nss1 (40MHz): 12.30 dBm ;
	802.11ac MCS0/Nss3 (40MHz): 13.79 dBm ;
	802.11ac MCS0/Nss1 (80MHz): 12.89 dBm ;
	802.11ac MCS0/Nss3 (80MHz): 13.50 dBm
	Mode 4 (Ant.5 PCB antenna / 5.74dBi)
	802.11ac MCS0/Nss1 (20MHz): 12.20 dBm ;
	802.11ac MCS0/Nss3 (20MHz): 16.97 dBm ;
	802.11ac MCS0/Nss1 (40MHz): 15.24 dBm ;
	802.11ac MCS0/Nss3 (40MHz): 16.95 dBm ;
	802.11ac MCS0/Nss1 (80MHz): 16.97 dBm ;
	802.11ac MCS0/Nss3 (80MHz): 16.89 dBm
	Band 2:
	Mode 1 (Ant.1 Dipole antenna / 1dBi) 802.11ac
	MCS0/Nss1 (20MHz): 23.81 dBm ; 802.11ac
	MCS0/Nss3 (20MHz): 23.80 dBm ; 802.11ac
	MCS0/Nss1 (40MHz): 22.67 dBm ; 802.11ac
	MCS0/Nss3 (40MHz): 23.65 dBm ; 802.11ac
	MCS0/Nss1 (80MHz): 16.84 dBm ; 802.11ac
	MCS0/Nss3 (80MHz): 17.23 dBm
	Mode 2 (Ant.3 Omnidirectional antenna / 6.7dBi)
	802.11ac MCS0/Nss1 (20MHz): 18.50 dBm ;
	802.11ac MCS0/Nss3 (20MHz): 23.26 dBm ;
	802.11ac MCS0/Nss1 (40MHz): 18.58 dBm ;
	802.11ac MCS0/Nss3 (40MHz): 21.70 dBm ;
	802.11ac MCS0/Nss1 (80MHz): 14.62 dBm ;
	802.11ac MCS0/Nss3 (80MHz): 15.60 dBm
	Mode 3 (Ant.4 Panel antenna / 9.2dBi)
	802.11ac MCS0/Nss1 (20MHz): 16.77 dBm ;
	802.11ac MCS0/Nss3 (20MHz): 20.79 dBm ;
	802.11ac MCS0/Nss1 (40MHz): 18.06 dBm ;
	802.11ac MCS0/Nss3 (40MHz): 18.83 dBm ;
	802.11ac MCS0/Nss1 (80MHz): 13.40 dBm ;
	802.11ac MCS0/Nss3 (80MHz): 13.66 dBm
	Mode 4 (Ant.5 PCB antenna / 5.74dBi)
	802.11ac MCS0/Nss1 (20MHz): 19.02 dBm ;
	802.11ac MCS0/Nss3 (20MHz): 23.80 dBm ;
	802.11ac MCS0/Nss1 (40MHz): 20.29 dBm ;
	802.11ac MCS0/Nss3 (40MHz): 23.65 dBm ;
	802.11ac MCS0/Nss1 (80MHz): 15.38 dBm ;
	802.11ac MCS0/Nss3 (80MHz): 16.55 dBm

	Band 3: Mode 1 (Ant.1 Dipole antenna / 1dBi) 802.11ac MCS0/Nss1 (20MHz): 23.83 dBm ; 802.11ac MCS0/Nss3 (20MHz): 23.98 dBm ; 802.11ac MCS0/Nss1 (40MHz): 23.84 dBm ; 802.11ac MCS0/Nss3 (40MHz): 23.73 dBm ; 802.11ac MCS0/Nss1 (80MHz): 23.67 dBm ; 802.11ac MCS0/Nss3 (80MHz): 23.89 dBm Mode 2 (Ant.3 Omnidirectional antenna / 6.7dBi) 802.11ac MCS0/Nss1 (20MHz): 18.50 dBm ; 802.11ac MCS0/Nss3 (20MHz): 23.29 dBm ; 802.11ac MCS0/Nss1 (40MHz): 21.53 dBm ; 802.11ac MCS0/Nss3 (40MHz): 23.26 dBm ; 802.11ac MCS0/Nss1 (80MHz): 23.28 dBm ; 802.11ac MCS0/Nss3 (80MHz): 23.16 dBm Mode 3 (Ant.4 Panel antenna / 9.2dBi) 802.11ac MCS0/Nss1 (20MHz): 16.77 dBm ; 802.11ac MCS0/Nss3 (20MHz): 20.70 dBm ; 802.11ac MCS0/Nss1 (40MHz): 19.28 dBm ; 802.11ac MCS0/Nss3 (40MHz): 20.74 dBm ; 802.11ac MCS0/Nss1 (80MHz): 20.72 dBm ; 802.11ac MCS0/Nss3 (80MHz): 20.66 dBm Mode 4 (Ant.5 PCB antenna / 5.74dBi) 802.11ac MCS0/Nss1 (20MHz): 20.77 dBm ; 802.11ac MCS0/Nss3 (20MHz): 23.91 dBm ; 802.11ac MCS0/Nss1 (40MHz): 23.20 dBm ; 802.11ac MCS0/Nss3 (40MHz): 23.73 dBm ; 802.11ac MCS0/Nss1 (80MHz): 23.67 dBm ; 802.11ac MCS0/Nss3 (80MHz): 23.89 dBm
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The following test modes were performed for all tests:

Mode 1. EUT + Antenna 1- Dipole Antenna - 5GHz

Mode 2. EUT + Antenna 3- Omnidirectional Antenna - 5GHz

Mode 3. EUT + Antenna 4- Panel Antenna - 5GHz

Mode 4. EUT + Antenna 5- PCB Antenna - 5GHz

Japan:

Power level-antenna combination for 2400 ~ 2483.5MHz:

Maximum Conducted Output Power	Mode 1 (Ant.1 Dipole antenna / 1.2dBi) 802.11b : 11.189dBm/MHz 802.11g : 11.185dBm/MHz 802.11n : 11.191dBm/MHz MCS 0 (HT20) ; 11.151dBm/MHz MCS 16 (HT20) 802.11n : 8.186dBm/MHz MCS 0 (HT40) ; 8.145dBm/MHz MCS 16 (HT40) Mode 2 (Ant.2 Element antenna / 5.2dBi) 802.11b : 12.112dBm/MHz 802.11g : 11.996dBm/MHz 802.11n : 12.127dBm/MHz MCS 0 (HT20) ; 12.121dBm/MHz MCS 16 (HT20) 802.11n : 9.083dBm/MHz MCS 0 (HT40) ; 9.041dBm/MHz MCS 16 (HT40) Mode 3 (Ant.4 Panel antenna / 9.4dBi) 802.11b : 11.428dBm/MHz 802.11g : 11.335dBm/MHz 802.11n : 11.419dBm/MHz MCS 0 (HT20) ; 11.437dBm/MHz MCS 16 (HT20) 802.11n : 8.428dBm/MHz MCS 0 (HT40) ; 8.437dBm/MHz MCS 16 (HT40) Mode 4 (Ant.5 PCB antenna / 4.94dBi) 802.11b : 12.076dBm/MHz 802.11g : 12.094dBm/MHz 802.11n : 12.097dBm/MHz MCS 0 (HT20) ; 12.098dBm/MHz MCS 16 (HT20) 802.11n : 9.034dBm/MHz MCS 0 (HT40) ; 9.085dBm/MHz MCS 16 (HT40)
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The following test modes were performed for all tests:

Mode 1. EUT + Antenna 1- Dipole Antenna - 2.4GHz

Mode 2. EUT + Antenna 2- Element Antenna - 2.4GHz

Mode 3. EUT + Antenna 4- Panel Antenna - 2.4GHz

Mode 4. EUT + Antenna 5- PCB Antenna - 2.4GHz

Power level-antenna combination for 5150 ~ 5350MHz:

Maximum Conducted Output Power	Mode 1 (Ant.1 Dipole antenna / 1dBi) MCS0/NSS1 Band 1: IEEE 802.11a : 8.507 dBm/MHz IEEE 802.11ac : 8.843 dBm/MHz (VHT20) ; 5.089 dBm/MHz (VHT40); 3.241 dBm/MHz (VHT80) Band 2: IEEE 802.11a : 8.641 dBm/MHz IEEE 802.11ac : 9.041 dBm/MHz (VHT20) ; 5.084 dBm/MHz (VHT40); 2.942 dBm/MHz (VHT80) MCS0/NSS3 Band 1: IEEE 802.11ac : 8.954 dBm/MHz (VHT20) ; 5.105 dBm/MHz (VHT40); 2.925 dBm/MHz (VHT80) Band 2: IEEE 802.11ac : 9.200 dBm/MHz (VHT20) ; 5.160 dBm/MHz (VHT40); 2.623 dBm/MHz (VHT80) Mode 2 (Ant.3 Omnidirectional antenna / 6.7dBi) MCS0/NSS1 Band 1: IEEE 802.11a : 9.894 dBm/MHz IEEE 802.11ac : 9.998 dBm/MHz (VHT20) ; 6.992 dBm/MHz (VHT40); 3.963 dBm/MHz (VHT80) Band 2: IEEE 802.11a : 9.990 dBm/MHz IEEE 802.11ac : 9.967 dBm/MHz (VHT20) ; 6.925 dBm/MHz (VHT40); 3.962 dBm/MHz (VHT80) MCS0/NSS3 Band 1: IEEE 802.11ac : 9.975 dBm/MHz (VHT20) ; 6.976 dBm/MHz (VHT40); 3.925 dBm/MHz (VHT80) Band 2: IEEE 802.11ac : 9.970 dBm/MHz (VHT20) ; 6.975 dBm/MHz (VHT40); 3.942 dBm/MHz (VHT80) Mode 3 (Ant.4 Panel antenna / 11.5dBi) MCS0/NSS1 Band 1: IEEE 802.11a : 9.241 dBm/MHz IEEE 802.11ac : 9.287 dBm/MHz (VHT20) ; 6.225 dBm/MHz (VHT40); 3.251 dBm/MHz (VHT80) Band 2: IEEE 802.11a : 9.229 dBm/MHz IEEE 802.11ac : 9.286 dBm/MHz (VHT20) ; 6.203 dBm/MHz (VHT40); 3.220 dBm/MHz (VHT80) MCS0/NSS3 Band 1: IEEE 802.11ac : 9.287 dBm/MHz (VHT20) ;
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	6.297 dBm/MHz (VHT40); 3.673 dBm/MHz (VHT80) Band 2: IEEE 802.11ac : 9.296 dBm/MHz (VHT20) ; 6.298 dBm/MHz (VHT40); 3.642 dBm/MHz (VHT80) Mode 4 (Ant.5 PCB antenna / 5.74dBi) MCS0/NSS1 Band 1: IEEE 802.11a : 9.994 dBm/MHz IEEE 802.11ac : 9.038 dBm/MHz (VHT20) ; 6.908 dBm/MHz (VHT40); 3.839 dBm/MHz (VHT80) Band 2: IEEE 802.11a : 9.846 dBm/MHz IEEE 802.11ac : 9.007 dBm/MHz (VHT20) ; 6.924 dBm/MHz (VHT40); 3.904 dBm/MHz (VHT80) MCS0/NSS3 Band 1: IEEE 802.11ac : 9.881 dBm/MHz (VHT20) ; 6.948 dBm/MHz (VHT40); 3.899 dBm/MHz (VHT80) Band 2: IEEE 802.11ac : 9.832 dBm/MHz (VHT20) ; 6.948 dBm/MHz (VHT40); 3.961 dBm/MHz (VHT80)
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The following test modes were performed for all tests:

- Mode 1. EUT + Antenna 1 - Dipole Antenna - 5GHz
- Mode 2. EUT + Antenna 3 - Omnidirectional Antenna - 5GHz
- Mode 3. EUT + Antenna 4 - Panel Antenna - 5GHz
- Mode 4. EUT + Antenna 5 - PCB Antenna - 5GHz

Power level-antenna combination for 5470 ~ 5725MHz:

Maximum Conducted Output Power	Mode 1 (Ant.1 Dipole antenna / 1dBi) MCS0/NSS1 IEEE 802.11a : 8.089 dBm/MHz IEEE 802.11ac : 8.796 dBm/MHz (VHT20) ; 4.882 dBm/MHz (VHT40); 2.369 dBm/MHz (VHT80) MCS0/NSS3 IEEE 802.11ac : 9.493 dBm/MHz (VHT20) ; 4.936 dBm/MHz (VHT40); 2.239 dBm/MHz (VHT80) Mode 2 (Ant.3 Omnidirectional antenna / 6.7dBi) MCS0/NSS1 IEEE 802.11a : 14.572 dBm/MHz IEEE 802.11ac : 15.071 dBm/MHz (VHT20) ; 11.946 dBm/MHz (VHT40); 8.117 dBm/MHz (VHT80) MCS0/NSS3 IEEE 802.11ac : 15.077 dBm/MHz (VHT20) ; 11.945 dBm/MHz (VHT40); 8.166 dBm/MHz (VHT80) Mode 3 (Ant.4 Panel antenna / 11.5dBi) MCS0/NSS1 IEEE 802.11a : 16.211 dBm/MHz IEEE 802.11ac : 16.291 dBm/MHz (VHT20) ; 13.263 dBm/MHz (VHT40); 10.232 dBm/MHz (VHT80) MCS0/NSS3 IEEE 802.11ac : 16.296 dBm/MHz (VHT20) ; 13.292 dBm/MHz (VHT40); 10.654 dBm/MHz (VHT80) Mode 4 (Ant.5 PCB antenna / 5.74dBi) MCS0/NSS1 IEEE 802.11a : 13.308 dBm/MHz IEEE 802.11ac : 14.111 dBm/MHz (VHT20) ; 11.065 dBm/MHz (VHT40); 7.308 dBm/MHz (VHT80) MCS0/NSS3 IEEE 802.11ac : 14.482 dBm/MHz (VHT20) ; 11.464 dBm/MHz (VHT40); 7.585 dBm/MHz (VHT80)
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The following test modes were performed for all tests:

- Mode 1. EUT + Antenna 1 - Dipole Antenna - 5GHz
- Mode 2. EUT + Antenna 3 - Omnidirectional Antenna - 5GHz
- Mode 3. EUT + Antenna 4 - Panel Antenna - 5GHz
- Mode 4. EUT + Antenna 5 - PCB Antenna - 5GHz

NCC: IEEE 802.11n/ac

Power level-antenna combination for 2400 ~ 2483.5MHz / 5725 ~ 5850MHz :

Maximum Conducted Output Power	For 2.4GHz Band: Mode 1 (Ant.1 Dipole antenna / 1.2dBi) MCS0 (20MHz): 25.47 dBm ; MCS0 (40MHz): 19.47 dBm ; MCS16 (20MHz): 25.65 dBm ; MCS16 (40MHz): 19.45 dBm ; Mode 2 (Ant.2 Element antenna / 5.2dBi) MCS0 (20MHz): 25.29 dBm ; MCS0 (40MHz): 18.58 dBm ; MCS16 (20MHz): 25.65 dBm ; MCS16 (40MHz): 18.62 dBm ; Mode 3 (Ant.4 Panel antenna / 7.1dBi) MCS0 (20MHz): 25.47 dBm ; MCS0 (40MHz): 18.77 dBm ; MCS16 (20MHz): 25.65 dBm ; MCS16 (40MHz): 18.97 dBm ; Mode 4 (Ant.5 PCB antenna / 4.94dBi) MCS0 (20MHz): 25.47 dBm ; MCS0 (40MHz): 20.83 dBm ; MCS16 (20MHz): 25.65 dBm ; MCS16 (40MHz): 21.09 dBm ; For 5GHz Band: Mode 5 (Ant.1 Dipole antenna / 1dBi) 802.11ac MCS0/Nss1 (20MHz): 24.40 dBm ; 802.11ac MCS0/Nss3 (20MHz): 24.90 dBm ; 802.11ac MCS0/Nss1 (40MHz): 23.76 dBm ; 802.11ac MCS0/Nss3 (40MHz): 24.24 dBm ; 802.11ac MCS0/Nss1 (80MHz): 21.42 dBm ; 802.11ac MCS0/Nss3 (80MHz): 22.09 dBm Mode 6 (Ant.3 Omnidirectional Antenna / 6.7dBi) 802.11ac MCS0/Nss1 (20MHz): 24.40 dBm ; 802.11ac MCS0/Nss3 (20MHz): 24.90 dBm ; 802.11ac MCS0/Nss1 (40MHz): 23.76 dBm ; 802.11ac MCS0/Nss3 (40MHz): 24.24 dBm ; 802.11ac MCS0/Nss1 (80MHz): 21.42 dBm ; 802.11ac MCS0/Nss3 (80MHz): 23.04 dBm Mode 7 (Ant.4 Panel Antenna / 9.2dBi) 802.11ac MCS0/Nss1 (20MHz): 24.40 dBm ; 802.11ac MCS0/Nss3 (20MHz): 24.90 dBm ; 802.11ac MCS0/Nss1 (40MHz): 23.76 dBm ; 802.11ac MCS0/Nss3 (40MHz): 24.24 dBm ; 802.11ac MCS0/Nss1 (80MHz): 21.27 dBm ; 802.11ac MCS0/Nss3 (80MHz): 21.01 dBm Mode 8 (Ant.5 PCB antenna / 5.74dBi) 802.11ac MCS0/Nss1 (20MHz): 24.40 dBm ; 802.11ac MCS0/Nss3 (20MHz): 24.90 dBm ; 802.11ac MCS0/Nss1 (40MHz): 23.76 dBm ; 802.11ac MCS0/Nss3 (40MHz): 24.24 dBm ; 802.11ac MCS0/Nss1 (80MHz): 22.20 dBm ; 802.11ac MCS0/Nss3 (80MHz): 21.81 dBm
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The following test modes were performed for all tests:

Mode 1. EUT + Antenna 1- Dipole Antenna - 2.4GHz

Mode 2. EUT + Antenna 2- Element Antenna - 2.4GHz

Mode 3. EUT + Antenna 4- Panel Antenna - 2.4GHz

Mode 4. EUT + Antenna 5- PCB Antenna - 2.4GHz

Mode 5. EUT + Antenna 1- Dipole Antenna - 5GHz

Mode 6. EUT + Antenna 3- Omnidirectional Antenna - 5GHz
Mode 7. EUT + Antenna 4- Panel Antenna - 5GHz
Mode 8. EUT + Antenna 5- PCB Antenna - 5GHz

NCC: 802.11a/b/g

Power level-antenna combination for 2400 ~ 2483.5MHz / 5725 ~ 5850MHz :

Maximum Conducted Output Power	Mode 1 (Ant.1 Dipole antenna / 1.2dBi) 11b: 25.03 MHz 11g: 25.70 MHz Mode 2 (Ant.2 Element antenna / 5.2dBi) 11b: 25.03 MHz 11g: 25.36 MHz Mode 3 (Ant.4 Panel antenna / 7.1dBi) 11b: 19.07 MHz 11g: 25.70 MHz Mode 4 (Ant.5 PCB antenna / 4.94dBi) 11b: 25.23 MHz 11g: 25.70 MHz Mode 5 (Ant.1 Dipole antenna / 1dBi) 11a: 24.54 MHz Mode 6 (Ant.3 Omnidirectional Antenna / 6.7dBi) 11a: 24.54 MHz Mode 7 (Ant.4 Panel Antenna / 9.2dBi) 11a: 24.54 MHz Mode 8 (Ant.5 PCB antenna / 5.74dBi) 11a: 24.54 MHz
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The following test modes were performed for all tests:

- Mode 1. EUT + Antenna 1- Dipole Antenna - 2.4GHz
- Mode 2. EUT + Antenna 2- Element Antenna - 2.4GHz
- Mode 3. EUT + Antenna 4- Panel Antenna - 2.4GHz
- Mode 4. EUT + Antenna 5- PCB Antenna - 2.4GHz
- Mode 5. EUT + Antenna 1- Dipole Antenna - 5GHz
- Mode 6. EUT + Antenna 3- Omnidirectional Antenna - 5GHz
- Mode 7. EUT + Antenna 4- Panel Antenna - 5GHz
- Mode 8. EUT + Antenna 5- PCB Antenna - 5GHz

NCC: IEEE 802.11n / ac

Power level-antenna combination for 5250 ~ 5350MHz / 5470 ~ 5725MHz :

Maximum Conducted Output Power	Band 2: Mode 1 (Ant.1 Dipole antenna / 1dBi) 802.11ac MCS0/Nss1 (20MHz): 16.96 dBm ; 802.11ac MCS0/Nss3 (20MHz): 16.94 dBm ; 802.11ac MCS0/Nss1 (40MHz): 16.80 dBm ; 802.11ac MCS0/Nss3 (40MHz): 16.74 dBm Mode 2 (Ant.3 Omnidirectional antenna / 6.7dBi) 802.11ac MCS0/Nss1 (20MHz): 11.50 dBm ; 802.11ac MCS0/Nss3 (20MHz): 16.14 dBm ; 802.11ac MCS0/Nss1 (40MHz): 14.21 dBm ; 802.11ac MCS0/Nss3 (40MHz): 16.28 dBm Mode 3 (Ant.4 Panel antenna / 9.2dBi) 802.11ac MCS0/Nss1 (20MHz): 10.00 dBm ; 802.11ac MCS0/Nss3 (20MHz): 13.75 dBm ; 802.11ac MCS0/Nss1 (40MHz): 12.49 dBm ; 802.11ac MCS0/Nss3 (40MHz): 13.66 dBm Mode 4 (Ant.5 PCB antenna / 5.74dBi) 802.11ac MCS0/Nss1 (20MHz): 12.39 dBm ; 802.11ac MCS0/Nss3 (20MHz): 16.94 dBm ; 802.11ac MCS0/Nss1 (40MHz): 15.22 dBm ; 802.11ac MCS0/Nss3 (40MHz): 16.74 dBm Band 3: Mode 1 (Ant.1 Dipole antenna / 1dBi) 802.11ac MCS0/Nss1 (20MHz): 23.83 dBm ; 802.11ac MCS0/Nss3 (20MHz): 23.98 dBm ; 802.11ac MCS0/Nss1 (40MHz): 23.84 dBm ; 802.11ac MCS0/Nss3 (40MHz): 23.73 dBm ; 802.11ac MCS0/Nss1 (80MHz): 23.67 dBm ; 802.11ac MCS0/Nss3 (80MHz): 23.89 dBm Mode 2 (Ant.3 Omnidirectional antenna / 6.7dBi) 802.11ac MCS0/Nss1 (20MHz): 18.50 dBm ; 802.11ac MCS0/Nss3 (20MHz): 23.29 dBm ; 802.11ac MCS0/Nss1 (40MHz): 21.53 dBm ; 802.11ac MCS0/Nss3 (40MHz): 23.26 dBm ; 802.11ac MCS0/Nss1 (80MHz): 23.28 dBm ; 802.11ac MCS0/Nss3 (80MHz): 23.16 dBm Mode 3 (Ant.4 Panel antenna / 9.2dBi) 802.11ac MCS0/Nss1 (20MHz): 16.77 dBm ; 802.11ac MCS0/Nss3 (20MHz): 20.70 dBm ; 802.11ac MCS0/Nss1 (40MHz): 19.28 dBm ; 802.11ac MCS0/Nss3 (40MHz): 20.74 dBm ; 802.11ac MCS0/Nss1 (80MHz): 20.72 dBm ; 802.11ac MCS0/Nss3 (80MHz): 20.66 dBm Mode 4 (Ant.5 PCB antenna / 5.74dBi) 802.11ac MCS0/Nss1 (20MHz): 20.77 dBm ; 802.11ac MCS0/Nss3 (20MHz): 23.91 dBm ; 802.11ac MCS0/Nss1 (40MHz): 23.20 dBm ; 802.11ac MCS0/Nss3 (40MHz): 23.73 dBm ; 802.11ac MCS0/Nss1 (80MHz): 23.67 dBm ; 802.11ac MCS0/Nss3 (80MHz): 23.89 dBm
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The following test modes were performed for all tests:

Mode 1. EUT + Antenna 1- Dipole Antenna - 5GHz

Mode 2. EUT + Antenna 3- Omnidirectional Antenna - 5GHz

Mode 3. EUT + Antenna 4- Panel Antenna - 5GHz

Mode 4. EUT + Antenna 5- PCB Antenna - 5GHz

NCC: IEEE 802.11a

Power level-antenna combination for 5250 ~ 5350MHz / 5470 ~ 5725MHz :

Maximum Conducted Output Power	Band 2: Mode 1 (Ant.1 Dipole antenna / 1dBi) 11a: 16.85 dBm Mode 2 (Ant.3 Omnidirectional antenna / 6.7dBi) 11a: 11.56 dBm Mode 3 (Ant.4 Panel antenna / 9.2dBi) 11a: 10.04 dBm Mode 4 (Ant.5 PCB antenna / 5.74dBi) 11a: 12.44 dBm\ Band 3: Mode 1 (Ant.1 Dipole antenna / 1dBi) 11a: 23.96 dBm Mode 2 (Ant.3 Omnidirectional antenna / 6.7dBi) 11a: 18.38 dBm Mode 3 (Ant.4 Panel antenna / 9.2dBi) 11a: 16.65 dBm Mode 4 (Ant.5 PCB antenna / 5.74dBi) 11a: 20.80 dBm
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The following test modes were performed for all tests:

Mode 1. EUT + Antenna 1- Dipole Antenna - 5GHz

Mode 2. EUT + Antenna 3- Omnidirectional Antenna - 5GHz

Mode 3. EUT + Antenna 4- Panel Antenna - 5GHz

Mode 4. EUT + Antenna 5- PCB Antenna - 5GHz