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Project No: CB10601223

Maximum Permissible Exposure Report

Applicant's company	ASUSTeK COMPUTER INC.
Applicant Address	4F, No. 150, Li-Te Rd., Peitou, Taipei 112, Taiwan
FCC ID	MSQ-RTGZ00
Manufacturer's company (1)	ASKEY TECHNOLOGY (JIANG SU) LTD
Manufacturer Address (1)	NO1388, Jiao Tong Road, Wujiang Economic Technological Development Area Jiangsu Province 215200 China
Manufacturer's company (2)	Compal Networking (KunShan) Co., LTD.
Manufacturer Address (2)	No. 520, Nabbang Rd., Economic & Technical Development Zone Kunshan, Jiangsu Province China

Product Name	Wireless-AC5300 Tri-band Gigabit Router, ROG Rapture Tri-band Gaming Router, Extreme Gaming Router
Brand Name	ASUS
Model Name	RT-AC5300, RT-AC5300R, RT-AC5300W, RT-AC5300P, RT-AC95U, RT-AC96U, GT-AC5300, ROG Rapture GT-AC5300
Ref. Standard(s)	47 CFR FCC Part 2 Subpart J, section 2.1091
Received Date	Apr. 28, 2015
Final Test Date	Jan. 24, 2017
Submission Type	Class II Change

Testing Laboratory
1190

Cliff Chang
SPORTON INTERNATIONAL INC.

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History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA532637-11	Rev. 01	Initial issue of report	Jan. 26, 2017

1. GENERAL DESCRIPTION

1.1. EUT General Information

RF General Information			
Evaluation Mode	Frequency Range (MHz)	Operating Frequency (MHz)	Modulation Type
2.4GHz WLAN	2400-2483.5	2412-2462	802.11b: DSSS (DBPSK, DQPSK, CCK) 802.11g/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
5GHz WLAN	5150-5250 5725-5850	5180-5240 5745-5825	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)

1.2. Table for Multiple Listing

The model numbers in the following table are all refer to the identical product.

Model No.	Description
RT-AC5300	The models are identical except for the model numbers as marketing strategy.
RT-AC5300R	
RT-AC5300W	
RT-AC5300P	
RT-AC95U	
RT-AC96U	
GT-AC5300	
ROG Rapture GT-AC5300	

Note: Model: RT-AC5300 was selected as representative model for the test and its data was recorded in this report.

The EUT has five types, which are identical to each other in all aspects except for the following table:

EUT	LAN Port	EUT Version	Transformer	Resistance (Size)	Thickness of Heat sink (mm)	Pad (mm)	Fan
EUT 1	8	Version 1, 2 (Rev 1.30)	SKU A	0402/0201	4.2mm/2mm	1mm/5mm	V
EUT 2	4	Version 1,2 (Rev 1.30)	SKU A	0402/0201	4.2mm/2mm	1mm/5mm	V / X
		Version 2 (Rev 1.30, Rev 1.31)	SKU A ~ SKU C	0402/0201	4.2mm/2mm	1mm/5mm	V / X
EUT 3	4	Version 2 (Rev 1.33)	SKU B	0402/0201	2mm	5mm	X
EUT 4	8	Version 2 (Rev 1.311)	SKU A	0402/0201	2mm	5mm	X
EUT 5	8	Version 2 (Rev1.411)	SKU A	0402/0201	2mm	5mm	X

Note 1: All the specification of test configurations and test modes were based on customer's request.
Note 2: V : With X :Without

The transformer information as below:

Transformer	Brand	LAN	LAN	WAN
SKU A	Mingtek	HN8011VG	HN8011VG	HN18101CG
SKU B	Mingtek	HN8014VG	HN8015VG	HN18101CG
SKU C	FCE	NS777207	NS777208	NS771802

The Version information as below:

Version			Rev 1.31	Rev 1.33	Rev 1.311	Rev 1.411
RF	2G	Mainchip	BCM4366	BCM4366	BCM4366	BCM4366
		TX	PA SE2623L	PA SE2623L	PA SE2623L	PA SE2623L
		RX	RX FEM SKY85201	RX FEM SKY85201	RX FEM SKY85201	Discrete RX BFP842 + RTC6619
	5G Low/ High Band	Mainchip	BCM4366	BCM4366	BCM4366	BCM4366
		TX	PA RFPA5542	PA RFPA5542	PA RFPA5542	PA RFPA5542
		RX	RX FEM SKY85605	RX FEM SKY85605	RX FEM SKY85614	RX FEM SKY85614
BB	CPU		BCM4709C0	BCM4709C0	BCM4908	BCM4908
	DDR		512MBx1	512MBx1	512MBx2	512MBx1
	Gigabit switch		RTL8365MB (Reserved)	RTL8365MB (Reserved)	BCM53134S	BCM53134S
	LAN port		4 (Reserved extra 4)	4 (Reserved extra 4)	8	8
	Flash		128MB	128MB	256MB	256MB
	EMI Filter for low voltage		MURATA/ NFM18PS105R0J3D	none	none	none
	Power IC		FR9618+ IT76630M	RT8290A	RT8290A+RT6220 +RT6217E	RT8290A+RT6220 +RT6217E
	USB		2.0x1/3.0x1	2.0x1/3.0x1	3.0x2	3.0x2

1.3. Table for Class II Change

This product is an extension of original one reported under Sporton project number: FA532637-04

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
1. Adding equipment names: ROG Rapture Tri-band Gaming Router and Extreme Gaming Router. 2. Adding model names: GT-AC5300 and ROG Rapture GT-AC5300.	1. It is not necessary to perform for all tests.
3. Adding two sets of antennas with lower gain. (P/N: C660-510391-A& C660-510392-A) 4. Adding three versions of the device: Rev 1.33&Rev 1.311&Rev 1.411	2. After evaluating, it is not necessary to verify.
5. Consider the component with precision and make sure each device in mass production to comply with regulation rule. Test it by mass product, not golden sample for version 2 4TX4RX 2.4G/5G B1.	3. Maximum Permissible Exposure

1.4. Testing Location

Testing Location			
☐	HWA YA	ADD :	No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.
		TEL :	886-3-327-3456 FAX : 886-3-327-0973
☒	JHUBEI	ADD :	No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C.
		TEL :	886-3-656-9065 FAX : 886-3-656-9085

2. MAXIMUM PERMISSIBLE EXPOSURE

2.1. Limit of Maximum Permissible Exposure

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	Averaging Time |E|², |H|² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	Averaging Time |E|², |H|² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

2.2. MPE Calculation Method

The MPE was calculated at 31 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

E (V/m) = $\frac{\sqrt{30 \times P \times G}}{d}$ Power Density: *Pd* (W/m²) = $\frac{E^2}{377}$

E = Electric field (V/m)

P = Peak RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

Pd = $\frac{30 \times P \times G}{377 \times d^2}$

2.3. Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure
EUT: Version 1
For 5GHz Band 1:
Antenna Type : Dipole Antenna
Conducted Power for IEEE 802.11ac MCS0/Nss1 VHT20: 26.47 dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
				(dBm)	(mW)			
31	5240	9.49	8.8932	26.4684	443.4459	0.326729	1	Complies

Note: $Directional\ Gain = 10\log\left[\frac{\sum_{j=1}^{Nss}\left\{\sum_{K=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$

For 5GHz Band 4:
Antenna Type : Dipole Antenna
Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT40): 26.46 dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
				(dBm)	(mW)			
31	5775	9.49	8.8932	26.4518	441.7485	0.325478	1	Complies

Note: $Directional\ Gain = 10\log\left[\frac{\sum_{j=1}^{Nss}\left\{\sum_{K=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$

For 2.4GHz Band:
Antenna Type : Dipole Antenna
Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT20): 27.50 dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
				(dBm)	(mW)			
31	2437	8.34	6.8243	27.5617	570.3849	0.322489	1	Complies

Note: $Directional\ Gain = 10\log\left[\frac{\sum_{j=1}^{Nss}\left\{\sum_{K=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$

Conclusion:

Both of the WLAN 2.4GHz Band, WLAN 5GHz Band 1 and WLAN 5GHz Band 4 can transmit simultaneously, the formula of calculated the MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + ...etc. < 1

CPD = Calculation power density
LPD = Limit of power density

Therefore, the worst-case situation is 0.322489 / 1 + 0.326729 / 1 + 0.325478 / 1 = 0.974696, which is less than "1". This confirmed that the device complies.

EUT: Version 2
For 5GHz Band 1:
Antenna Type : Dipole Antenna
Conducted Power for IEEE 802.11 ac MCS0/Nss1 (VHT20): 26.46 dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
				(dBm)	(mW)			
31	5200	9.49	8.8932	26.4625	442.8465	0.326287	1	Complies

Note: $Directional\ Gain = 10\log\left[\frac{\sum_{j=1}^{Nss}\left\{\sum_{K=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$

For 5GHz Band 4:
Antenna Type : Dipole Antenna
Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT40): 26.46 dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
				(dBm)	(mW)			
31	5795	9.49	8.8932	26.4607	442.6563	0.326147	1	Complies

Note: $Directional\ Gain = 10\log\left[\frac{\sum_{j=1}^{Nss}\left\{\sum_{K=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$

For 2.4GHz Band:
Antenna Type : Dipole Antenna
Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT20): 27.50 dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
				(dBm)	(mW)			
31	2437	8.34	6.8243	27.4956	561.7704	0.317618	1	Complies

Note: $Directional\ Gain = 10\log\left[\frac{\sum_{j=1}^{Nss}\left\{\sum_{K=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$

Conclusion:

Both of the WLAN 2.4GHz Band, WLAN 5GHz Band 1 and WLAN 5GHz Band 4 can transmit simultaneously, the formula of calculated the MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + ...etc. < 1

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is 0.317618 / 1 + 0.326287 / 1 + 0.326147 / 1= 0.970052, which is less than "1". This confirmed that the device complies.