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Project No: CB10506079

Maximum Permissible Exposure Report

Applicant's company	TP-LINK TECHNOLOGIES CO., LTD.
Applicant Address	Building 24 (floors 1,3,4,5) and 28 (floors1-4) Central Science and Technology Park, Nanshan, Shenzhen, 518057 China
FCC ID	TE7C5400
Manufacturer's company	TP-LINK TECHNOLOGIES CO., LTD.
Manufacturer Address	Building 24 (floors 1,3,4,5) and 28 (floors1-4) Central Science and Technology Park, Nanshan, Shenzhen, 518057 China

Product Name	AC5400 Wireless Tri-Band MU-MIMO Gigabit Router
Brand Name	TP-LINK
Model Name	Archer C5400
Ref. Standard(s)	47 CFR FCC Part 2 Subpart J, section 2.1091
Received Date	Oct. 28, 2015
Final Test Date	May 20, 2016
Submission Type	Class II Change

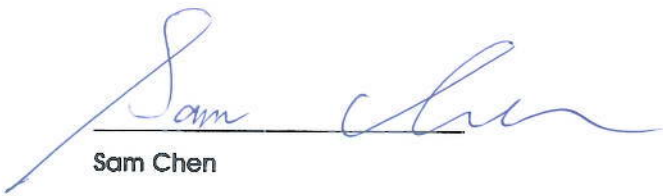

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History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA5N0101-01	Rev. 01	Initial issue of report	Jul. 13, 2016

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 Class II Change

This product is an extension of original one reported under Sporton project number: FA5N0101

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

Modifications	Performance Checking
1. Adding an adapter (Model name: HKA0012050-7G).	Do not effect the test results.
2. Removing Repeater function.	
3. Adding beam-forming function for 802.11n/ac.	Maximum Permissible Exposure.
4. Updating test rule of 5GHz Band 4 to "15.407 (b)(4)(i) of New Rules (ET Docket No. 13-49; FCC 16-24)" from "Old Rules".	Maximum Permissible Exposure.

Note: Maximum Permissible Exposure of 2.4GHz and 5GHz Band1 Non-beamforming is based on original report.

1.3. 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/ cm ²)	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/ cm ²)	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:

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

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

For 5GHz Band 1

For Non-Beamforming Mode:

Antenna Type : PCB Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT40): 29.94dBm

Distance (cm)	Test Freq. (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
31	5230	1.80	1.5136	29.9446	987.3149	0.1238	1	Complies

For Beamforming Mode:

Antenna Type : PCB Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT40): 28.10dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
31	5230	7.82	6.0542	28.10	646.2108	0.3241	1	Complies

Note: $DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right] = 7.82 \text{ dBi}$

For 5GHz Band 4

For Non-Beamforming Mode:

Antenna Type : PCB Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT40): 29.92dBm

Distance (cm)	Test Freq. (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
31	5795	1.80	1.5136	29.92	981.5266	0.1231	1	Complies

For Beamforming Mode:

Antenna Type : PCB Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT40): 28.12dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
31	5795	7.82	6.0542	28.12	648.9395	0.3255	1	Complies

Note: $DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right] = 7.82 \text{ dBi}$

For 2.4GHz Band

For Non-Beamforming Mode:

Antenna Type : PCB Antenna

Conducted Power for IEEE 802.11b: 29.97dBm

Distance (cm)	Test Freq. (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
31	2437	1.80	1.5136	29.9725	993.6857	0.1246	1	Complies

For Beamforming Mode:

Antenna Type : PCB Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT20): 28.14dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
31	2437	7.82	6.0542	28.14	652.2950	0.3271	1	Complies

Note: $DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right] = 7.82 \text{ dBi}$

Conclusion:

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

$$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$$

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is $0.3271/1 + 0.3241/1 + 0.3255/1 = 0.9767$, which is less than "1". This confirmed that the device complies.