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Project No: CB10610364

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	TE7C5400V2
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	Jun. 13, 2017
Submission Type	Class II Change


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SPORTON INTERNATIONAL INC.





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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 5250-5350 5470-5725 5725-5850	5180-5240 5260-5320 5500-5700 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: FA5N0101-01

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

Modifications	Performance Checking						
1. Adding 5GHz band 2 and Band 3 (5250~5350 MHz, 5470~5725 MHz) for this device. 2. Adding two types (Type 1: 5210+5290, Type 2: 5530+5610) of 80+80 MHz mode, and they supports non-beamforming function only.	Maximum Permissible Exposure.						
3. Updating chip version to "BCM4366 C0" from "BCM4366 B1". The difference between original version and new version as below: <table border="1" data-bbox="252 1444 1034 1686"> <thead> <tr> <th>Version</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>BCM4366 B1 (Original)</td> <td>Single User Multiple Input Multiple Output</td> </tr> <tr> <td>BCM4366 C0 (New)</td> <td>Multi-User Multiple-Input Multiple-Output</td> </tr> </tbody> </table> 4. Changing applicant's company to "TP-Link Technologies Co., Ltd." from "TP-LINK TECHNOLOGIES CO., LTD." 5. Changing brand name to "TP-Link" from "TP-LINK". 6. Changing FCC ID to "TE7C5400V2" from "TE7C5400".	Version	Description	BCM4366 B1 (Original)	Single User Multiple Input Multiple Output	BCM4366 C0 (New)	Multi-User Multiple-Input Multiple-Output	It does not need to re-test.
Version	Description						
BCM4366 B1 (Original)	Single User Multiple Input Multiple Output						
BCM4366 C0 (New)	Multi-User Multiple-Input Multiple-Output						

Note: 2.4GHz band and 5GHz band 1, 4 of Maximum Permissible Exposure are based on original test report.

1.3. Testing Location

Testing Location		
<input type="checkbox"/>	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
<input checked="" type="checkbox"/>	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:

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		Tune-up EIRP		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)	(dBm)	(mW)			
31	5230	7.82	6.0542	28.10	646.2108	36.00	3981.0717	0.3298	1	Complies

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

For 5GHz Band 2:

Antenna Type : PCB Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT40): 22.12dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Tune-up EIRP		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)	(dBm)	(mW)			
31	5310	7.82	6.0542	22.12	162.7977	30.00	1000.0000	0.0828	1	Complies

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

For 5GHz Band 3:

Antenna Type : PCB Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT40): 22.14dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Tune-up EIRP		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)	(dBm)	(mW)			
31	5550	7.82	6.0542	22.14	163.6264	30.00	1000.0000	0.0828	5550	Complies

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

For 5GHz Band 4:

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		Tune-up EIRP		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)	(dBm)	(mW)			
31	5795	7.82	6.0542	28.12	648.9395	36.00	3981.0717	0.3298	1	Complies

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

For 2.4GHz Band:

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		Tune-up EIRP		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)	(dBm)	(mW)			
31	2437	7.82	6.0542	28.14	652.2950	36.00	3981.0717	0.3298	1	Complies

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

Conclusion:

Both of the 2.4GHz WLAN function, 5GHz WLAN Band1/Band2 function and 5GHz WLAN Band 3/Band4 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 $0.3298 / 1 + 0.3298 / 1 + 0.3298 / 1 = 0.9894$, which is less than "1".

This confirmed that the device complies.