



RF Exposure Evaluation Report

APPLICANT : TP-LINK TECHNOLOGIES CO., LTD.
EQUIPMENT : N600 Universal Dual Band WiFi Entertainment
Adapter with 4 Ports
BRAND NAME : TP-LINK
MODEL NAME : TL-WA890EA
FCC ID : TE7WA890EA
STANDARD : 47 CFR Part 2.1091

We, SPORTON INTERNATIONAL INC., would like to declare that the device has been evaluated in accordance with 47 CFR Part 2.1091, and pass the limit. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Eric Huang / Deputy Manager

Approved by: Jones Tsai / Manager

SPORTON INTERNATIONAL INC.

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA341603	Rev. 01	Initial issue of report	Aug. 12, 2013

1. Administration Data

1.1. Testing Laboratory

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978

1.2. Applicant

Company Name	TP-LINK TECHNOLOGIES CO., LTD.
Address	Building 24 (floors 1,3,4,5) and 28 (floors1-4) Central Science and Technology Park, Shennan Rd, Nanshan, Shenzhen, China

1.3. Manufacturer

Company Name	TP-LINK TECHNOLOGIES CO., LTD.
Address	Building 24 (floors 1,3,4,5) and 28 (floors1-4) Central Science and Technology Park, Shennan Rd, Nanshan, Shenzhen, China

2. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	N600 Universal Dual Band WiFi Entertainment Adapter with 4 Ports
Brand Name	TP-LINK
Model Name	TL-WA890EA
FCC ID	TE7WA890EA
Wireless Technology and Frequency Range	WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5700 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz
Mode	• 802.11a/b/g/n HT20/HT40
Antenna Type	Chain Port 0: PCB Antenna Chain Port 1: PCB Antenna
EUT Stage	Production Unit

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. 5600 MHz ~ 5650 MHz is notched.

3. Maximum RF average output power among production units

IEEE 802.11 Average Power (dBm)						
Antenna Chain	Ant.0				Ant.0+1	
Mode/Band	11b	11g	HT20	HT40	HT20	HT40
WLAN 2.4GHz	18.5	18.5	18	18	18.5	18.5

IEEE 802.11 Average Power (dBm)					
Antenna Chain	Ant.0			Ant.0+1	
Mode/Band	a	HT20	HT40	HT20	HT40
WLAN 5.2GHz	16	15.5	17	15	17.5
WLAN 5.3GHz	18.5	18.5	18.5	18	18.5
WLAN 5.5GHz	18	18	18.5	18	18.5
WLAN 5.8GHz	18	18	18.5	18	18.5

4. Conducted RF Output Power (Unit: dBm)

<WLAN 2.4GHz Conducted Power>

2.4GHz 802.11b RF Power (dBm)			
Channel	01	07	13
Frequency (MHz) / Ant. Chain	2412	2442	2472
Ant.0	17.58	17.74	18.05

2.4GHz 802.11g RF Power (dBm)			
Channel	01	07	13
Frequency (MHz) / Ant. Chain	2412	2442	2472
Ant.0	17.76	18.00	18.03

2.4GHz 802.11n HT20 RF Power (dBm)			
Channel	01	07	13
Frequency (MHz) / Ant. Chain	2412	2442	2472
SISO Ant.0	17.68	17.90	17.64
MIMO Ant.0+1(0)	14.52	14.89	15.04
MIMO Ant.0+1(1)	14.85	15.07	15.33
MIMO Ant.0+1	17.70	17.99	18.20

2.4GHz 802.11n HT40 RF Power (dBm)			
Channel	03	07	11
Frequency (MHz) / Ant. Chain	2422	2442	2462
SISO Ant.0	17.50	17.60	17.63
MIMO Ant.0+1(0)	14.66	14.79	15.07
MIMO Ant.0+1(1)	14.45	14.66	14.91
MIMO Ant.0+1	17.57	17.74	18.00

<WLAN 5.2GHz Conducted Power>

5.2GHz 802.11a RF Power (dBm)			
Channel	36	44	48
Frequency (MHz) / Ant. Chain	5180	5220	5240
Ant.0	15.56	14.82	15.29

5.2GHz 802.11n HT20 RF Power (dBm)			
Channel	36	44	48
Frequency (MHz) / Ant. Chain	5180	5220	5240
SISO Ant.0	15.32	14.84	15.14
MIMO Ant.0+1(0)	12.06	11.42	11.87
MIMO Ant.0+1(1)	11.67	11.20	11.78
MIMO Ant.0+1	14.88	14.32	14.84

5.2GHz 802.11n HT40 RF Power (dBm)		
Channel	38	46
Frequency (MHz) / Ant. Chain	5190	5230
SISO Ant.0	16.51	16.42
MIMO Ant.0+1(0)	14.33	14.11
MIMO Ant.0+1(1)	13.58	13.72
MIMO Ant.0+1	16.98	16.93

<WLAN 5.3GHz Conducted Power>

5.3GHz 802.11a RF Power (dBm)			
Channel	52	60	64
Frequency (MHz) / Ant. Chain	5260	5300	5320
Ant.0	18.09	17.93	17.81

5.3GHz 802.11n HT20 RF Power (dBm)			
Channel	52	60	64
Frequency (MHz) / Ant. Chain	5260	5300	5320
SISO Ant.0	18.06	17.73	17.85
MIMO Ant.0+1(0)	15.28	15.47	15.38
MIMO Ant.0+1(1)	13.97	14.17	13.63
MIMO Ant.0+1	17.68	17.88	17.60

5.3GHz 802.11n HT40 RF Power (dBm)		
Channel	54	62
Frequency (MHz) / Ant. Chain	5270	5310
SISO Ant.0	18.26	17.92
MIMO Ant.0+1(0)	15.85	15.61
MIMO Ant.0+1(1)	14.05	14.13
MIMO Ant.0+1	18.05	17.94

<WLAN 5.5GHz Conducted Power>

5.5GHz 802.11a RF Power (dBm)			
Channel	100	116	140
Frequency (MHz) / Ant. Chain	5500	5580	5700
Ant.0	17.92	17.82	17.57

5.5GHz 802.11n HT20 RF Power (dBm)			
Channel	100	116	140
Frequency (MHz) / Ant. Chain	5500	5580	5700
SISO Ant.0	17.89	17.75	17.62
MIMO Ant.0+1(0)	14.96	15.11	14.31
MIMO Ant.0+1(1)	14.77	14.55	15.09
MIMO Ant.0+1	17.88	17.85	17.73

5.5GHz 802.11n HT40 RF Power (dBm)			
Channel	102	110	134
Frequency (MHz) / Ant. Chain	5510	5550	5670
SISO Ant.0	18.29	18.08	17.87
MIMO Ant.0+1(0)	15.06	14.81	14.51
MIMO Ant.0+1(1)	15.03	15.16	14.56
MIMO Ant.0+1	18.06	18.00	17.55

<WLAN 5.8GHz Conducted Power>

5.8GHz 802.11a RF Power (dBm)			
Channel	149	157	165
Frequency (MHz) / Ant. Chain	5745	5785	5825
Ant.0	17.81	17.65	17.45

5.8GHz 802.11n HT20 RF Power (dBm)			
Channel	149	157	165
Frequency (MHz) / Ant. Chain	5745	5785	5825
SISO Ant.0	17.75	17.61	17.98
MIMO Ant.0+1(0)	14.02	14.29	14.16
MIMO Ant.0+1(1)	14.94	15.52	15.13
MIMO Ant.0+1	17.51	17.96	17.68

5.8GHz 802.11n HT40 RF Power (dBm)		
Channel	151	159
Frequency (MHz) / Ant. Chain	5755	5795
SISO Ant.0	18.13	18.05
MIMO Ant.0+1(0)	14.60	14.03
MIMO Ant.0+1(1)	15.45	15.16
MIMO Ant.0+1	18.06	17.64



5. RF Exposure Limit Introduction

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f ²)	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				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

R = Distance from Transmitting Antenna

6. Radio Frequency Radiation Exposure Evaluation

6.1. Standalone Power Density Calculations

Mode	Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Maximum Conducted Power (dBm)	Source Base-Time Average Power (mW)	EIRP (mW)	Calculated RF Exposure (mW/cm ²)	Limit (mW/cm ²)
WLAN 2.4GHz 802.11b	2412.00	2.70	1.86	18.50	70.79	131.83	0.03	1.00
WLAN 2.4GHz 802.11g	2412.00	2.70	1.86	18.50	70.79	131.83	0.03	1.00
WLAN 2.4GHz 802.11n HT20	2412.00	2.70	1.86	18.00	63.10	117.49	0.02	1.00
WLAN 2.4GHz 802.11n HT40	2422.00	2.70	1.86	18.00	63.10	117.49	0.02	1.00
WLAN 5.2GHz 802.11a	5180.00	3.20	2.09	16.00	39.81	83.18	0.02	1.00
WLAN 5.3GHz 802.11a	5260.00	3.50	2.24	18.50	70.79	158.49	0.03	1.00
WLAN 5.5GHz 802.11a	5500.00	4.50	2.82	18.00	63.10	177.83	0.04	1.00
WLAN 5.8GHz 802.11a	5745.00	5.00	3.16	18.00	63.10	199.53	0.04	1.00
WLAN 5.2GHz 802.11n HT20	5180.00	3.20	2.09	15.50	35.48	74.13	0.01	1.00
WLAN 5.3GHz 802.11n HT20	5260.00	3.50	2.24	18.50	70.79	158.49	0.03	1.00
WLAN 5.5GHz 802.11n HT20	5500.00	4.50	2.82	18.00	63.10	177.83	0.04	1.00
WLAN 5.8GHz 802.11n HT20	5745.00	5.00	3.16	18.00	63.10	199.53	0.04	1.00
WLAN 5.2GHz 802.11n HT40	5190.00	3.20	2.09	17.00	50.12	104.71	0.02	1.00
WLAN 5.3GHz 802.11n HT40	5270.00	3.50	2.24	18.50	70.79	158.49	0.03	1.00
WLAN 5.5GHz 802.11n HT40	5510.00	4.50	2.82	18.50	70.79	199.53	0.04	1.00
WLAN 5.8GHz 802.11n HT40	5755.00	5.00	3.16	18.50	70.79	223.87	0.04	1.00

WLAN (Ant. Chain 0+1)

Mode	Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Maximum Conducted Power (dBm)	Source Base-Time Average Power (mW)	EIRP (mW)	Calculated RF Exposure (mW/cm ²)	Limit (mW/cm ²)
WLAN 2.4GHz 802.11n HT20	2412.00	3.12	2.05	18.50	70.79	145.21	0.03	1.00
WLAN 2.4GHz 802.11n HT40	2422.00	3.12	2.05	18.50	70.79	145.21	0.03	1.00
WLAN 5.2GHz 802.11n HT20	5180.00	2.86	1.93	15.00	31.62	61.09	0.01	1.00
WLAN 5.3GHz 802.11n HT20	5260.00	2.61	1.82	18.00	63.10	115.08	0.02	1.00
WLAN 5.5GHz 802.11n HT20	5500.00	4.03	2.53	18.00	63.10	159.59	0.03	1.00
WLAN 5.8GHz 802.11n HT20	5745.00	4.62	2.90	18.00	63.10	182.81	0.04	1.00
WLAN 5.2GHz 802.11n HT40	5190.00	2.86	1.93	17.50	56.23	108.64	0.02	1.00
WLAN 5.3GHz 802.11n HT40	5270.00	2.61	1.82	18.50	70.79	129.12	0.03	1.00
WLAN 5.5GHz 802.11n HT40	5510.00	4.03	2.53	18.50	70.79	179.06	0.04	1.00
WLAN 5.8GHz 802.11n HT40	5755.00	4.62	2.90	18.50	70.79	205.12	0.04	1.00

Note: According to "Maximum RF average output power among production units" to evaluate radiation exposure.

Conclusion:

Per 47 CFR §2.1091, EUT source-based time-averaged ERP < 1.5W for RF operating frequency ≤ 1.5GHz, EUT source-based time-averaged EIRP < 3W for RF operating frequency > 1.5GHz, routine evaluation of MPE is not required; MPE calculation is sufficient to show compliance. The MPE calculation results indicate that the EUT complies with the RF exposure limit of ANSI/IEEE C95.1-1992.