RF Exposure Evaluation Declaration

Product Name	:	AC1750 Wireless Dual Band Gigabit Router
Model No.	:	Archer C8
FCC ID	:	TE7C8V2

Applicant	:	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

Date of Receipt	:	Mar. 03, 2016
Issued Date	:	Jun. 21, 2016
Report No.	:	1632027R-RF-US-P20V01
Report Version	:	V1.1

Test Report Certification

Issued Date : Jun. 21, 2016
Report No. : 1632027R-RF-US-P20V01

Product Name	:	AC1750 Wireless Dual Band Gigabit Router
Applicant	:	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
Manufacturer	:	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
Model No.	:	Archer C8
FCC ID	:	TE7C8V2
Brand Name	:	AC 100-240V, 50/60Hz
EUT Voltage	:	TP-LINK
Applicable Standard	:	KDB 447498D01V06 FCC Part1.1310(b)
Test Result	:	Complied
Performed Location	:	Quietek Corporation - Suzhou EMC Laboratory No.99 Hongye Rd., Suzhou Industrial Park, Suzhou, 215006, Jiangsu, China TEL: +86-512-6251-5088 / FAX: +86-512-6251-5098 FCC Registration Number: 800392

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Laboratory Information

We, **QuieTek Corporation**, are an independent EMC and safety consultancy that was established the whole facility in our laboratories. The test facility has been accredited/accepted(audited or listed) by the following related bodies in compliance with ISO 17025, EN 45001 and specified testing scope:

Taiwan R.O.C.	**:**	**BSMI, NCC, TAF**
USA	**:**	**FCC**
Japan	**:**	**VCCI**
China	**:**	**CNAS**

The related certificate for our laboratories about the test site and management system can be downloaded from QuieTek Corporation's Web Site : http://www.quietek.com/english/about/certificates.aspx?bval=5
The address and introduction of QuieTek Corporation's laboratories can be founded in our Web site : http://www.quietek.com/index_en.aspx
If you have any comments, Please don't hesitate to contact us. Our contact information is as below:

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TEL:+886-3-592-8858 / FAX:+886-3-592-8859 E-Mail : service@quietek.com

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TEL : 886-2-8601-3788 / FAX : 886-2-8601-3789 E-Mail : service@quietek.com

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TEL : +86-512-6251-5088 / FAX : 86-512-6251-5098 E-Mail : service@quietek.com

History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
1632027R-RF-US-P20V01	V1.0	Initial Issued Report	May. 27, 2016
1632027R-RF-US-P20V01	V1.1	Modify the Directional Gain	Jun. 21, 2016

1. RF Exposure Evaluation

1.1. Limits

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm2)	Average Time (Minutes)
(A) Limits for Occupational/ Control Exposures				
300-1500	--	--	F/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/ Uncontrolled Exposures				
300-1500	--	--	F/1500	6
1500-100,000	--	--	1	30

F= Frequency in MHz

Friis Formula

Friis transmission formula: Pd = (Pout*G)/(4*pi*r2)

Where

Pd = power density in mW/cm2

Pout = output power to antenna in mW

G = gain of antenna in linear scale

Pi = 3.1416

R = distance between observation point and center of the radiator in cm

Pd id the limit of MPE, 1 mW/cm2 . If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

1.2. Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.
The temperature and related humidity: 18℃and 78％ RH.

1.3. Test Result of RF Exposure Evaluation

Product	:	AC1750 Wireless Dual Band Gigabit Router
Test Item	:	RF Exposure Evaluation
Test Site	:	AC-6

2.4G Antenna：

Model No.	N/A				
Antenna manufacturer	TP-LINK				
Antenna Delivery	☐	1*TX+1*RX	☐	2*TX+2*RX	☒ 3*TX+3*RX
Antenna technology	☐	SISO			
	☒	MIMO	☐	Basic	
			☒	CDD	
			☐	Beam-forming	
Antenna Type	☒	External	☒	Dipole	
	☐	Internal	☐	PIFA	
			☐	PCB	
			☐	Ceramic Chip Antenna	
			☐	Metal plate type F antenna	

Antenna Technology	Ant Gain (dBi)	Directional Gain (dBi)	
		For Power	For PSD
☒ CDD	Ant 0: 2.1 Ant 1: 2.1 Ant 2: 2.1	2.1	6.87
☐ Beam-forming	N/A	N/A	N/A

5G Antenna：

Antenna Model	PIFA Antenna						
Antenna Manufacturer	TPlink						
Antenna Delivery	☐	1*TX+1*RX	☐	2*TX+2*RX	☒	3*TX+3*RX	
Antenna Technology	☐	SISO					
	☒	MIMO	☐	Basic methodology with NANT transmit antennas			
			☐	Sectorized antenna systems			
			☐	Cross-polarized antennas			
			☐	Unequal antenna gains, with equal transmit powers			
			☒	Spatial Multiplexing			
			☒	Cyclic Delay Diversity (CDD)			
Antenna Type	Dipole						

Antenna Gain

Antenna Technology		Ant Gain	Directional Gain	
			For Power	For PSD
☒	CDD	Ant0: 1.7 Ant1: 1.7 Ant2: 1.7	1.7	6.47
☒	Beam-forming	Ant0: 1.7 Ant1: 1.7 Ant2: 1.7	6.47	6.47

Note: 1: The EUT has three antennas, and each port has same gain, they transmit signals are correlated with each other.

(1) 5G Directional gain for Beamforming Calculation is:

Directional gain = G_{ANT} + 10 log(N_{ANT}/N_{SS}) dBi≈6.47dBi.

(2) 2.4G Directional gain for CDD Calculation is:

a. For power measurements

Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4;

Directional gain = G_{ANT} + Array Gain=2.1dBi

b. For power spectral density (PSD) measurements

Directional gain = G_{ANT} + Array Gain≈6.87dBi

5G Directional gain for CDD Calculation is:

c. For power measurements

Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4;

Directional gain = G_{ANT} + Array Gain=1.7dBi

d. For power spectral density (PSD) measurements

Directional gain = G_{ANT} + Array Gain≈6.47dBi

- Output Power into Antenna & RF Exposure Evaluation Distance:

Standlone modes

2.4GHz:

Test Mode	Frequency Band (MHz)	Maximum Output Power to Antenna (dBm)	Directional Gain (dBi)	Power Density at R = 20 cm (mW/cm2)
802.11b/g/n(20MHz)	2412 - 2462	29.36	2.1	0.278
802.11n(40MHz)	2422 - 2452	18.71	2.1	0.024

5GHz:

Test Mode	Frequency Band (MHz)	Maximum Output Power to Antenna (dBm)	Directional Gain (dBi)	Power Density at R = 20 cm (mW/cm2)
802.11a/n(20MHz)/ac(20MHz) with CDD	5180 - 5240 5745 - 5825	26.84	1.7	0.142
802.11n(40MHz)/ac(40MHz) with CDD	5190 - 5230 5755 - 5795	26.85	1.7	0.142
802.11ac(80MHz) with CDD	5210	15.67	1.7	0.011
802.11a/n(20MHz) /ac(20MHz) with Beam-forming	5180 - 5240 5745 - 5825	27.42	6.47	0.487
802.11n(40MHz) /ac(40MHz) with Beam-forming	5190 - 5230 5755 - 5795	28.87	6.47	0.680
802.11ac(80MHz) with Beam-forming	5210	16.55	6.47	0.040

Simultaneous transmission:

Test Mode	Frequency Band (MHz)	Maximum Output Power to Antenna (dBm)	Directional Gain (dBi)	Power Density at R = 20 cm (mW/cm2)
802.11b/g/n(20MHz)	2412 - 2462	29.36	2.1	0.278
802.11n(40MHz) /ac(40MHz) with Beam-forming	5190 - 5230 5755 - 5795	28.87	6.47	0.680
Simultaneous transmission power density				0.958

So according to transmission formula: Pd = (Pout*G)/(4*pi*r^2) and the power density limit according to KDB 447498D01V06 and FCC Part1.1310(b), the limit is 1mW/cm^2

Safety Distance Calculation Formula:

The power flux:

$$S = \frac{P*G_{(\theta,\phi)}}{4*\pi*r^2}$$

So safety distance as following:

$$r = \sqrt{\frac{P*G}{4*\pi*S}}$$

P = input power of the antenna

G = antenna gain relative to an isotropic antenna

θ, Φ = elevation and azimuth angles.

r = distance from the antenna to the point of investigation

Test Mode	Frequency Range (MHz)	Maximum EIRP (dBm)	Limit of Power Density S(mW/cm^2)	Safety Distance r(cm)
802.11b/g/n(20MHz)	2412 - 2462	31.46	1	19.58
802.11n(40MHz) /ac(40MHz) with Beam-forming	5190 - 5230 5755 - 5795	35.34	1	

Note: The safety distance is 19.58cm for AC1750 Wireless Dual Band Gigabit Router without any other radio equipment.

The End