

RF Exposure Evaluation declaration

Product Name : Wireless-AC1900 Dual Band Gigabit Router
Model No. : RT-AC68U, RT-AC68R, RT-AC68RW, TM-AC1900
FCC ID. : MSQ-RTAC68U

Applicant : ASUSTeK COMPUTER INC.

Address : 4F, No. 150, Li-Te Rd., Peitou, Taipei, Taiwan

Date of Receipt : 2014/03/05

Date of Declaration : 2014/03/14

Report No. : 1430116R-RF-US-Exp

Report Version : V1.0



The declaration results relate only to the samples calculated.

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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/cm ²)	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: $Pd = (Pout \cdot G) / (4 \cdot \pi \cdot r^2)$

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 is 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°C and 78% RH.

1.3. Test Result of RF Exposure Evaluation

Product	Wireless-AC1900 Dual Band Gigabit Router
Test Mode	Transmit (CDD Mode)
Test Condition	RF Exposure Evaluation

Antenna Gain

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.91dBi or 1.55 in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11b			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
1	2412	209.4112	0.06457
6	2437	227.5097	0.07016
11	2462	223.8721	0.06903

IEEE 802.11g			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
1	2412	157.3983	0.04854
6	2437	633.8697	0.19546
11	2462	174.1807	0.05371

The power density Pd (4th column) at a distance of 20 cm calculated from the Friis transmission formula is far below the limit of 1 mW/cm².

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Test Condition	RF Exposure Evaluation

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Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11n (20MHz) ANT 0+1+2			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
1	2412	105.1962	0.03244
6	2437	509.3309	0.15706
11	2462	153.8155	0.04743

IEEE 802.11n (40MHz) ANT 0+1+2			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
3	2422	73.9605	0.02281
6	2437	151.0080	0.04657
9	2452	101.6249	0.03134

The power density Pd (4th column) at a distance of 20 cm calculated from the Friis transmission formula is far below the limit of 1 mW/cm².

Product	Wireless-AC1900 Dual Band Gigabit Router
Test Mode	Transmit (CDD Mode)
Test Condition	RF Exposure Evaluation

Antenna Gain

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 4.44dBi or 2.78 in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11a			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
36	5180	16.4816	0.00912
44	5220	17.0608	0.00944
48	5240	16.5196	0.00914

IEEE 802.11a			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
149	5745	831.7638	0.46002
157	5785	939.7233	0.51973
165	5825	905.7326	0.50093

The power density Pd (4th column) at a distance of 20 cm calculated from the Friis transmission formula is far below the limit of 1 mW/cm².

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Test Condition	RF Exposure Evaluation

Antenna Gain

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 4.44dBi or 2.78 in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11 n(20MHz) ANT 0+1+2			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
36	5180	16.7109	0.00924
44	5220	16.3305	0.00903
48	5240	16.8267	0.00931

IEEE 802.11 n(20MHz) ANT 0+1+2			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
149	5745	801.6781	0.44338
157	5785	957.1941	0.52939
165	5825	933.2543	0.51615

The power density Pd (4th column) at a distance of 20 cm calculated from the Friis transmission formula is far below the limit of 1 mW/cm².

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Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11 n(40MHz) ANT 0+1+2			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
38	5190	37.6704	0.02083
46	5230	35.9749	0.01990

IEEE 802.11 n(40MHz) ANT 0+1+2			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
151	5755	695.0243	0.38439
159	5795	895.3648	0.49519

The power density Pd (4th column) at a distance of 20 cm calculated from the Friis transmission formula is far below the limit of 1 mW/cm².

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Antenna Gain

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Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11 ac(80MHz) ANT 0+1+2			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
42	5210	47.9733	0.02653

IEEE 802.11 ac(80MHz) ANT 0+1+2			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
155	5775	454.9881	0.25164

The power density Pd (4th column) at a distance of 20 cm calculated from the Friis transmission formula is far below the limit of 1 mW/cm².

Product	Wireless-AC1900 Dual Band Gigabit Router
Test Mode	Transmit (Beamforming Mode)
Test Condition	RF Exposure Evaluation

Antenna Gain

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.91dBi or 1.55 in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11b			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
1	2412	187.4995	0.05782
6	2437	189.2344	0.05835
11	2462	154.5254	0.04765

IEEE 802.11g			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
1	2412	97.2747	0.03000
6	2437	317.6874	0.09796
11	2462	68.3912	0.02109

The power density Pd (4th column) at a distance of 20 cm calculated from the Friis transmission formula is far below the limit of 1 mW/cm².

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Test Condition	RF Exposure Evaluation

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Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11n (20MHz) ANT 0+1+2			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
1	2412	171.0015	0.05273
6	2437	522.3962	0.16109
11	2462	147.2313	0.04540

IEEE 802.11n (40MHz) ANT 0+1+2			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
3	2422	119.1791	0.03675
6	2437	177.1740	0.05463
9	2452	78.8860	0.02433

The power density Pd (4th column) at a distance of 20 cm calculated from the Friis transmission formula is far below the limit of 1 mW/cm².

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Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11a			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
36	5180	21.4783	0.01188
44	5220	20.8930	0.01156
48	5240	21.0863	0.01166

IEEE 802.11a			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
149	5745	386.3670	0.21368
157	5785	399.9447	0.22119
165	5825	377.5722	0.20882

The power density Pd (4th column) at a distance of 20 cm calculated from the Friis transmission formula is far below the limit of 1 mW/cm².

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Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11 n(20MHz) ANT 0+1+2			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
36	5180	21.6272	0.01196
44	5220	21.7270	0.01202
48	5240	21.7771	0.01204

IEEE 802.11 n(20MHz) ANT 0+1+2			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
149	5745	463.4469	0.25631
157	5785	476.4310	0.26350
165	5825	460.2566	0.25455

The power density Pd (4th column) at a distance of 20 cm calculated from the Friis transmission formula is far below the limit of 1 mW/cm².

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IEEE 802.11 n(40MHz) ANT 0+1+2			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
38	5190	21.0863	0.01166
46	5230	23.3884	0.01294

IEEE 802.11 n(40MHz) ANT 0+1+2			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
151	5755	461.3176	0.25514
159	5795	476.4310	0.26350

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IEEE 802.11 ac(80MHz) ANT 0+1+2			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
42	5210	21.5278	0.01191

IEEE 802.11 ac(80MHz) ANT 0+1+2			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
155	5775	458.1419	0.25338

The power density Pd (4th column) at a distance of 20 cm calculated from the Friis transmission formula is far below the limit of 1 mW/cm².