

RF Exposure Evaluation declaration

Product Name : Wireless-AC2200 Tri Band Gigabit Router
Trade Name : ASUS
Model No. : Lyra Voice
FCC ID. : MSQ-RTHU00

Applicant : ASUSTeK COMPUTER INC.

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

Date of Receipt : Jun. 24, 2018

Date of Declaration : Oct. , 2018

Report No. : 1860341R-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: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot r^2)$

Where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

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

P_d 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

WiFi

Product	Wireless-AC2200 Tri 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 0.458 dBi or 1.11dBi in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11b (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
1	2412	578.895	0.128
6	2437	827.180	0.183
11	2462	432.613	0.096

IEEE 802.11g (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
1	2412	267.178	0.059
6	2437	832.914	0.184
11	2462	328.927	0.073

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-AC2200 Tri 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 0.458 dBi or 1.11dBi in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11ac (20MHz) (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
1	2412	267.178	0.059
6	2437	803.526	0.177
11	2462	237.137	0.052

IEEE 802.11ac (40MHz) (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
3	2422	182.516	0.040
6	2437	351.803	0.078
9	2452	208.066	0.046

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-AC2200 Tri Band Gigabit Router
Test Mode	Transmit_BF
Test Condition	RF Exposure Evaluation

Antenna Gain

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 0.458 dBi or 1.11dBi in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802. 11ac (20MHz) (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
1	2412	253.046	0.056
6	2437	778.216	0.172
11	2462	231.207	0.051

IEEE 802. 11ac (40MHz) (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
3	2422	169.903	0.038
6	2437	343.400	0.076
9	2452	202.349	0.045

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-AC2200 Tri Band Gigabit Router
Test Mode	Transmit_Filter 1_CDD
Test Condition	RF Exposure Evaluation

Antenna Gain

5G (Low band) Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.546 dBi or 1.80 dBi in linear scale.

5G (High band) Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.721 dBi or 1.87 dBi in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11a (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
36	5180	580.363	0.208
40	5220	543.626	0.195
44	5240	590.201	0.211

IEEE 802.11a (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
149	5745	922.784	0.343
157	5785	878.011	0.327
165	5825	882.064	0.328

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-AC2200 Tri Band Gigabit Router
Test Mode	Transmit_Filter 1_CDD
Test Condition	RF Exposure Evaluation

Antenna Gain

5G (Low band) Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.546 dBi or 1.80 dBi in linear scale.

5G (High band) Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.721 dBi or 1.87 dBi in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11n (20MHz) (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
36	5180	512.980	0.184
40	5220	560.919	0.201
44	5240	580.898	0.208

IEEE 802.11n (20MHz) (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
149	5745	881.252	0.328
157	5785	844.501	0.314
165	5825	854.083	0.318

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-AC2200 Tri Band Gigabit Router
Test Mode	Transmit_Filter 1_CDD
Test Condition	RF Exposure Evaluation

Antenna Gain

5G (Low band) Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.546 dBi or 1.80 dBi in linear scale.

5G (High band) Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.721 dBi or 1.87 dBi in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11n (40MHz) (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
38	5190	372.907	0.134
46	5230	801.678	0.287

IEEE 802.11n (40MHz) (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
151	5755	902.194	0.336
159	5795	947.109	0.352

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-AC2200 Tri Band Gigabit Router
Test Mode	Transmit_Filter 1_CDD
Test Condition	RF Exposure Evaluation

Antenna Gain

5G (Low band) Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.546 dBi or 1.80 dBi in linear scale.

5G (High band) Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.721 dBi or 1.87 dBi in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11ac (80MHz) (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
42	5210	296.688	0.106

IEEE 802.11ac (80MHz) (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
155	5775	397.375	0.148

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-AC2200 Tri Band Gigabit Router
Test Mode	Transmit_Filter 1_BF
Test Condition	RF Exposure Evaluation

Antenna Gain

5G (Low band) Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.546 dBi or 1.80 dBi in linear scale.

5G (High band) Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.721 dBi or 1.87 dBi in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11n (20MHz) (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
36	5180	512.980	0.184
40	5220	560.919	0.201
44	5240	580.898	0.208

IEEE 802.11n (20MHz) (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
149	5745	864.968	0.322
157	5785	829.087	0.308
165	5825	825.278	0.307

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-AC2200 Tri Band Gigabit Router
Test Mode	Transmit_Filter 1_BF
Test Condition	RF Exposure Evaluation

Antenna Gain

5G (Low band) Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.546 dBi or 1.80 dBi in linear scale.

5G (High band) Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.721 dBi or 1.87 dBi in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11n (40MHz) (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
38	5190	372.907	0.134
46	5230	801.678	0.287

IEEE 802.11n (40MHz) (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
151	5755	897.016	0.334
159	5795	939.291	0.349

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-AC2200 Tri Band Gigabit Router
Test Mode	Transmit_Filter 1_BF
Test Condition	RF Exposure Evaluation

Antenna Gain

5G (Low band) Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.546 dBi or 1.80 dBi in linear scale.

5G (High band) Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.721 dBi or 1.87 dBi in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11ac (80MHz) (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
42	5210	296.688	0.106

IEEE 802.11ac (80MHz) (ANT 0+1)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
155	5775	397.375	0.148

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.

BT 2.0

Product	Wireless-AC2200 Tri 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 1.96 dBi or 1.57 dBi in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

GFSK			
Bluetooth Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
00	2402	3.459	0.001
39	2441	4.276	0.001
78	2480	4.560	0.001

$\pi/4$ DQPSK			
Bluetooth Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
00	2402	1.321	0.00
39	2441	1.679	0.001
78	2480	1.914	0.001

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-AC2200 Tri 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 1.96 dBi or 1.57 dBi in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

8DQPSK			
Bluetooth Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
00	2402	1.3900	0.000
39	2441	1.7060	0.001
78	2480	2.2130	0.001

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.

BT 4.0

Product	Wireless-AC2200 Tri 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 1.96 dBi or 1.57 dBi in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

GFSK			
Bluetooth Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
00	2402	2.046	0.001
19	2440	2.673	0.001
39	2480	3.597	0.001

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-AC2200 Tri Band Gigabit Router
Test Mode	Transmit
Test Condition	RF Exposure Evaluation

Power Density (2.4GHz) (mW/cm ²)	Power Density (5GHz) (mW/cm ²)	Total Power Density (2.4GHz+5GHz) (mW/cm ²)	Limit (mW/cm ²)
0.184	0.352	0.536	1