IEEE C95.1

KDB 447498 D01 v06

47 C.F.R. Part 1, Subpart I, Section 1.1310
47 C.F.R. Part 2, Subpart J, Section 2.1091

RF EXPOSURE REPORT

For

AC1300 IoT Router

Model: X10R

Data Applies To: X10 ; X10S

Trade Name: ASRock

Issued for

ASRock Incorporation

2F., No.37, Sec. 2, Jhongyang S. Rd., Beitou Dist., Taipei City 11270, Taiwan (R.O.C.)

Issued by

Compliance Certification Services Inc.
Hsinchu Lab.
NO. 989-1, Wenshan Rd., Shangshan Village,
Qionglin Township, Hsinchu County 30741, Taiwan (R.O.C.)
http://www.ccsrf.com
service@ccsrf.com

Issued Date: February 18, 2017

Testing Laboratory
0240

Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	02/18/2017	Initial Issue	All Page	Michelle Chiu

TABLE OF CONTENTS

1. TEST REPORT CERTIFICATION

We hereby certify that:

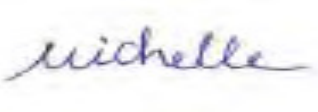
The equipment has been tested by Compliance Certification Services Inc., and found compliance with the requirement of the applicable standards. The test record, data evaluation and Equipment under Test (EUT) configurations represented herein are true and accurate accounts of the measurement of the sample's RF characteristics under the conditions specified in this report.

APPLICABLE STANDARD	
Standard	**Test Result**
IEEE C95.1 KDB 447498 D01 v06 47 C.F.R. Part 1, Subpart I, Section 1.1310 47 C.F.R. Part 2, Subpart J, Section 2.1091	No non-compliance noted

Approved by:

Sb. Lu
Sr. Engineer

Prepared by:



Michelle Chiu
Report coordinator

2. Limit

According to §15.247(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this chapter.

3. EUT Specification

Product Name	AC1300 IoT Router
Model Number	X10R
Data Applies To	X10 ; X10S
Identify Number	T161103D21
Received Date	October 24, 2016
Frequency band (Operating)	802.11b/g/gn HT20, 802.11ac VHT20 Mode: 2412MHz ~ 2462MHz 802.11gn HT40 Mode: 2422MHz ~ 2452MHz 802.11a, 802.11ac VHT20, 802.11ac VHT40 Mode: 5180 MHz ~ 5240 MHz / 5745 MHz ~ 5825 MHz 802.11ac VHT40 Mode: 5190 MHz ~ 5230 MHz / 5755 MHz ~ 5795 MHz 802.11ac VHT80 Mode: 5210 MHz / 5775 MHz Zigbee Mode: 2405MHz ~ 2480MHz LoRa Mode: 902.5 MHz to 927.5 MHz
Device category	Mobile (>20cm separation)
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm^2) ☒ General Population/Uncontrolled exposure (S=1mW/cm^2)
Antenna Specification	WiFi 2.4GHz Mode: Dipole Antenna × 2 Ant. 1 (Left) / Chain 0, Antenna Gain: 5.73dBi Ant. 2 (Right) / Chain 1, Antenna Gain: 5.60 dBi WiFi 5GHz Mode : Dipole Antenna × 2, Ant. 1 (Left) / Chain 0 , Antenna Gain : 5.43 dBi Ant. 2 (Right) / Chain 1, Antenna Gain : 5.28 dBi ZigBee Mode: PIFA Antenna × 1, Antenna Gain : 2.55dBi LoRa Mode: Dipole Antenna × 1, Antenna Gain : 1.17dBi For Beamforming Directional Gain : 8.37dBi

Maximum average output power	IEEE 802.11b Mode: 24.05 dBm IEEE 802.11g Mode: 21.94 dBm IEEE 802.11ac VHT20 MCS0 Mode: 22.07 dBm IEEE 802.11ac VHT40 MCS0 Mode: 17.16 dBm Zigbee Mode: 14.05 dBm LoRa Mode: 18.74 dBm For Non-beamforming : UNII Band 1/ Master: IEEE 802.11a Mode: 20.45 dBm IEEE 802.11ac VHT20 NSS1/MCS0 Mode: 20.40 dBm IEEE 802.11ac VHT40 NSS1/MCS0 Mode: 19.29 dBm IEEE 802.11ac VHT80 NSS1/MCS0 Mode: 15.10 dBm UNII Band 1 / Client: IEEE 802.11a Mode: 18.47 dBm IEEE 802.11ac VHT20 NSS1/MCS0 Mode: 18.85 dBm IEEE 802.11ac VHT40 NSS1/MCS0 Mode: 19.29 dBm IEEE 802.11ac VHT80 NSS1/MCS0 Mode: 15.10 dBm UNII Band 3: IEEE 802.11a Mode: 22.27 dBm IEEE 802.11ac VHT20 NSS1/MCS0 Mode: 22.25 dBm IEEE 802.11ac VHT40 NSS1/MCS0 Mode: 22.32 dBm IEEE 802.11ac VHT80 NSS1/MCS0 Mode: 20.03 dBm For Beamforming UNII Band 1 / Master : IEEE 802.11ac VHT20 NSS1/MCS0 Mode: 19.03 dBm IEEE 802.11ac VHT40 NSS1/MCS0 Mode: 18.16 dBm IEEE 802.11ac VHT80 NSS1/MCS0 Mode: 15.73 dBm UNII Band 1 / Client : IEEE 802.11ac VHT20 NSS1/MCS0 Mode: 19.03 dBm IEEE 802.11ac VHT40 NSS1/MCS0 Mode: 18.16 dBm IEEE 802.11ac VHT80 NSS1/MCS0 Mode: 15.73 dBm UNII Band 3: IEEE 802.11ac VHT20 NSS1/MCS0 Mode: 20.36 dBm IEEE 802.11ac VHT40 NSS1/MCS0 Mode: 20.25 dBm IEEE 802.11ac VHT80 NSS1/MCS0 Mode: 19.16 dBm
Evaluation applied	MPE Evaluation*

Power Adapter:

No.	Manufacturer	Model No.	Power Input	Power Output
1	APD	WB-18D12R	100-240Vac, 50-60Hz, 0.5A Max.	12Vdc, 1.5A

The difference of the series model

Model Number	Difference	
	Function	External Antenna Quantity
X10	Router + Zigbee	2
X10R	Router + Zigbee+LoRa(Sub-G)	3
X10S	Router + Zigbee+LoRa(Sub-G)	3

Remark:

1. For more details, please refer to the User's manual of the EUT.
2. This submittal(s) (test report) is intended for FCC ID: 2AFEB-X10 filing.
3. The model X10R was considered the main model for testing.

4. Test Results

No non-compliance noted.

Calculation

Given $E = \frac{\sqrt{30 \times P \times G}}{d}$ & $S = \frac{E^2}{3770}$

Where E = Field strength in Volts / meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{3770 d^2}$$

Changing to units of mW and cm, using:

P (mW) = P (W) / 1000 and

d (cm) = d(m) / 100

Yields

$$S = \frac{30 \times (P/1000) \times G}{377 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$ ***Equation 1***

Where d = Distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm^2

5. Maximum Permissible Exposure

Substituting the MPE safe distance using d = **20** cm into Equation 1:

$$S = 0.000199 \times P \times G$$

Where

P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²

Mode	Frequency (MHz)	Power (dBm)	Ant. Gain (dBi)	Distance (cm)	Power density (mW/cm²)	Limit (mW/cm²)
IEEE 802.11b	2437	24.05	5.73	20	0.1891	1
IEEE 802.11g	2437	21.94	5.73	20	0.1163	1
IEEE 802.11ac VHT20 MCS0	2437	22.07	5.73	20	0.1199	1
IEEE 802.11ac VHT40 MCS0	2437	17.16	5.73	20	0.0387	1
Zigbee	2405	14.05	2.55	20	0.0091	1
LoRa	902.5	18.74	1.17	20	0.0195	1
For Non-beamforming :						
UNII Band 1:						
IEEE 802.11a	5200	20.45	5.43	20	0.077	1
IEEE 802.11ac VHT20 NSS1/MCS0	5200	20.40	5.43	20	0.0762	1
IEEE 802.11ac VHT40 NSS1/MCS0	5230	19.29	5.43	20	0.059	1
IEEE 802.11ac VHT80 NSS1/MCS0	5210	15.10	5.43	20	0.0225	1
UNII Band 3:						
IEEE 802.11a	5745	22.27	5.43	20	0.1171	1
IEEE 802.11ac VHT20 NSS1/MCS0	5745	22.25	5.43	20	0.1166	1
IEEE 802.11ac VHT40 NSS1/MCS0	5755	22.32	5.43	20	0.1185	1
IEEE 802.11ac VHT80 NSS1/MCS0	5775	20.03	5.43	20	0.0699	1

For Beamforming :						
UNII Band 1:						
IEEE 802.11ac VHT20 NSS1/MCS0	5180	19.03	8.37	20	0.1093	1
IEEE 802.11ac VHT40 NSS1/MCS0	5230	18.16	8.37	20	0.0895	1
IEEE 802.11ac VHT80 NSS1/MCS0	5210	15.73	8.37	20	0.0511	1
UNII Band 3:						
IEEE 802.11ac VHT20 NSS1/MCS0	5745	20.36	8.37	20	0.1485	1
IEEE 802.11ac VHT40 NSS1/MCS0	5755	20.25	8.37	20	0.1448	1
IEEE 802.11ac VHT80 NSS1/MCS0	5775	19.16	8.37	20	0.1126	1

Simultaneously MPE

Simultaneously MPE = MPE 1 / Limit 1 + MPE 2 / Limit2 + ……..

WiFi / ZiBee 2.4GHz + 5GHz + LoRa Mode

Simultaneously MPE = (0.1891 / 1) + (0.1485 / 1)+(0.0195 / 1) = **0.3571 mW/cm^2**