FCC Maximum Permissible RF Exposure (MPE) Estimation Report

In accordance with the requirements of

FCC 47 CFR Part 2(2.1091), ANSI/IEEE C95.1-1992 and

447498 D01 General RF Exposure Guidance v06

Product Name：	AILA Sit & Play™
Trademark：	Animal Island Learning Adventure™
Model Name：	X4C-US19
Family Model：	X4C-01-01, X4C-01-01B, X4C-01-01G, X4C-01-01P
Report No.：	S19112504703003
FCC ID：	2AU9S-X4C-US19

Prepared for

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TEST RESULT CERTIFICATION

Applicant's name	:	DMAI (Guangzhou) Co, Ltd.
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Manufacturer's Name	:	Hunan Yuning Electronic Co.,Ltd
Address	:	(the new western industrial town)Baota community, Tongshan street, NingYuan County, Hunan province,China
Product description		AILA Sit & Play™
Product name	:	AILA Sit & Play™
Trademark	:	Animal Island Learning Adventure™
Model and/or type reference	:	X4C-US19
Family Model	:	X4C-01-01, X4C-01-01B, X4C-01-01G, X4C-01-01P
Standards	:	FCC 47 CFR Part 1(1.1310) FCC 47 CFR Part 2(2.1091) ANSI/IEEE C95.1-1992 447498 D01 GENERAL RF EXPOSURE GUIDANCE V06

This device described above has been tested by Shenzhen NTEK. Testing has shown that this device is capable of compliance with MPE specified in FCC 47 CFR Part 2(2.1091) and ANSI/IEEE C95.1-1992. The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

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Date of Test

Date (s) of performance of tests..... : 25 Nov. 2019 ~ 23 Dec, 2019

Date of Issue ..... : 23 Dec, 2019

Test Result ..... : **Pass**

Prepared By (Test Engineer) : Jerry Xie

(Jerry Xie)

Approved By (Lab Manager) : Sam . Chen

(Sam Chen)

※ ※ Revision History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.01	Initial Test Report Release	23 Dec, 2019	

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1 General Information

1.1 RF Exposure Requirements

1.1.1 RF Exposure Limits

Table - Limits For Maximum Permissible Exposure (MPE)

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 Exposure				
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
300-1,500			f/300	6
1,500-100,000			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
300-1,500			f/1500	30
1,500-100,000			1.0	30
f = frequency in MHz * = Plane-wave equivalent power density				

A rough estimation of the expected exposure in power flux density on a given point can be made with the following equation:

$$S = \frac{P_t * G_t}{4 * \pi * R^2}$$

Where:

S = Power density (mW/cm^2)
P_t = Conducted output power (dBm)
G_t = numeric gain of the antenna in the direction of interest relative to an isotropic radiator (dBi)
R= distance to the centre of radiation of the antenna (cm)
EIRP = $P_t * G_t$

The antenna of the product, under normal use condition is at least 20 cm away from the body of the user. Warning statement to the user for keeping at least 20cm separation distance and the prohibition of operating to a person has been printed on the user's manual. Therefore, the S of the device is calculated with R=20cm, and if it is below the limit S, then we can conclude the device complies with the rules.

1.1.2 Additional Description

An estimation of MPE in this application for product is used to ensure if it complies to the rules of the standard in the regulation list above.

Maximum permissible exposure (MPE) refers to the RF energy that is acceptable for human exposure. It is broken down into two categories, Occupational/controlled and General population/uncontrolled.

Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

We analysis if it comply with the limits for General population/uncontrolled exposure. The FCC's MPE limits for field strength and power density are given in 47CFR 1.1310(Table below).These limits are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP), and also partly based on guidelines recommended by the American National Standards Institute (ANSI) in Section 4.1 of ANSI/IEEE C95.1.

1.2 EUT Description

Device Information			
Product Name	AILA Sit & Play™		
Trade Name	Animal Island Learning Adventure™		
Model Name	X4C-US19		
Family Model	X4C-01-01, X4C-01-01B, X4C-01-01G, X4C-01-01P		
FCC ID	2AU9S-X4C-US19		
Device Phase	Identical Prototype		
Exposure Category	General population / Uncontrolled environment		
Antenna Type	PCB Print Antenna		
Antenna Gain	Ant 1: 2dBi for WLAN2.4G and WLAN5G Ant 2: 2dBi for WLAN2.4G and WLAN5G		
Device Operating Configurations			
Supporting Mode(s)	WLAN 2.4G/5.2G/5.3G/5.6G/5.8G		
Test Modulation	WLAN(DSSS/OFDM)		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	WLAN 2.4G	2412-2462	
	WLAN 5.2G	5180-5240	
	WLAN 5.3G	5250-5350	
	WLAN 5.6G	5500-5700	
	WLAN 5.8G	5745-5825	

1.3 Test specification(s)

FCC 47 CFR Part 1(1.1310)
FCC 47 CFR Part 2(2.1091)
ANSI/IEEE C95.1-1992
KDB 447498 D01 General RF Exposure Guidance v06

1.4 Ambient Condition

Ambient temperature	20°C – 24°C
Relative Humidity	30% – 70%

2 RF Output Power

2.4G:

Test Channel	Frequency (MHz)	Power Setting	Duty Cycle Factor (dB)	Peak Output Power(dBm)		Total	LIMIT (dBm)	Verdict
				ANT 1	ANT 2	(dBm)		
802.11b								
1	2412	Default	0	12.79	11.73	-	30	PASS
6	2437	Default	0	12.29	10.31	-	30	PASS
11	2462	Default	0	12.48	12.91	-	30	PASS
802.11g								
1	2412	Default	0	12.36	15.06	-	30	PASS
6	2437	Default	0	12.13	13.78	-	30	PASS
11	2462	Default	0	12.2	13.73	-	30	PASS
802.11n HT20								
1	2412	Default	0	12.37	15.06	18.93	30	PASS
6	2437	Default	0	12.23	13.7	18.04	30	PASS
11	2462	Default	0	12.56	13.62	18.13	30	PASS
802.11n HT40								
3	2422	Default	0	12.85	14.88	18.99	30	PASS
6	2437	Default	0	12.73	13.56	18.18	30	PASS
9	2452	Default	0	12.02	13.97	18.11	30	PASS

5.2G:

Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Duty Factor (dB)	Total Power (dBm)	Limit (dBm)	Verdict
NVNT	802.11a	5180	Ant 1	9.79	0	-	24	Pass
NVNT	802.11a	5200	Ant 1	9.93	0	-	24	Pass
NVNT	802.11a	5240	Ant 1	9.81	0	-	24	Pass
NVNT	802.11a	5180	Ant 2	9.62	0	-	24	Pass
NVNT	802.11a	5200	Ant 2	9.7	0	-	24	Pass
NVNT	802.11a	5240	Ant 2	9.56	0	-	24	Pass
NVNT	802.11ac20	5180	Ant 1	9.62	0	12.52	24	Pass
NVNT	802.11ac20	5180	Ant 2	9.4	0		24	Pass
NVNT	802.11ac20	5200	Ant 1	9.76	0	12.65	24	Pass
NVNT	802.11ac20	5200	Ant 2	9.51	0		24	Pass
NVNT	802.11ac20	5240	Ant 1	9.68	0	12.52	24	Pass
NVNT	802.11ac20	5240	Ant 2	9.34	0		24	Pass
NVNT	802.11ac40	5190	Ant 1	9.28	0	12.56	24	Pass
NVNT	802.11ac40	5190	Ant 2	9.81	0		24	Pass
NVNT	802.11ac40	5230	Ant 1	9.45	0	12.61	24	Pass
NVNT	802.11ac40	5230	Ant 2	9.74	0		24	Pass
NVNT	802.11ac80	5210	Ant 1	9.37	0	12.42	24	Pass
NVNT	802.11ac80	5210	Ant 2	9.44	0		24	Pass
NVNT	802.11n(HT20)	5180	Ant 1	9.66	0	12.61	24	Pass
NVNT	802.11n(HT20)	5180	Ant 2	9.53	0		24	Pass
NVNT	802.11n(HT20)	5200	Ant 1	9.79	0	12.71	24	Pass
NVNT	802.11n(HT20)	5200	Ant 2	9.6	0		24	Pass
NVNT	802.11n(HT20)	5240	Ant 1	9.7	0	12.58	24	Pass
NVNT	802.11n(HT20)	5240	Ant 2	9.44	0		24	Pass
NVNT	802.11n(HT40)	5190	Ant 1	9.35	0	12.24	24	Pass
NVNT	802.11n(HT40)	5190	Ant 2	9.1	0		24	Pass
NVNT	802.11n(HT40)	5230	Ant 1	9.52	0	12.37	24	Pass
NVNT	802.11n(HT40)	5230	Ant 2	9.19	0		24	Pass

5.3G:

Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Duty Factor (dB)	Total Power (dBm)	Limit (dBm)	Verdict
NVNT	802.11a	5260	Ant 1	9.73	0	-	24	Pass
NVNT	802.11a	5280	Ant 1	9.8	0	-	24	Pass
NVNT	802.11a	5320	Ant 1	10.63	0	-	24	Pass
NVNT	802.11a	5260	Ant 2	9.58	0	-	24	Pass
NVNT	802.11a	5280	Ant 2	9.72	0	-	24	Pass
NVNT	802.11a	5320	Ant 2	10.58	0	-	24	Pass
NVNT	802.11ac20	5260	Ant 1	9.73	0	12.64	24	Pass
NVNT	802.11ac20	5260	Ant 2	9.53	0		24	Pass
NVNT	802.11ac20	5280	Ant 1	10.05	0	12.85	24	Pass
NVNT	802.11ac20	5280	Ant 2	9.62	0		24	Pass
NVNT	802.11ac20	5320	Ant 1	10.75	0	13.62	24	Pass
NVNT	802.11ac20	5320	Ant 2	10.47	0		24	Pass
NVNT	802.11ac40	5270	Ant 1	9.43	0	12.35	24	Pass
NVNT	802.11ac40	5270	Ant 2	9.25	0		24	Pass
NVNT	802.11ac40	5310	Ant 1	10.18	0	13.04	24	Pass
NVNT	802.11ac40	5310	Ant 2	9.88	0		24	Pass
NVNT	802.11ac80	5290	Ant 1	9.77	0	12.55	24	Pass
NVNT	802.11ac80	5290	Ant 2	9.29	0		24	Pass
NVNT	802.11n(HT20)	5260	Ant 1	9.77	0	12.62	24	Pass
NVNT	802.11n(HT20)	5260	Ant 2	9.45	0		24	Pass
NVNT	802.11n(HT20)	5280	Ant 1	10.01	0	12.80	24	Pass
NVNT	802.11n(HT20)	5280	Ant 2	9.56	0		24	Pass
NVNT	802.11n(HT20)	5320	Ant 1	10.71	0	13.58	24	Pass
NVNT	802.11n(HT20)	5320	Ant 2	10.42	0		24	Pass
NVNT	802.11n(HT40)	5270	Ant 1	9.59	0	12.42	24	Pass
NVNT	802.11n(HT40)	5270	Ant 2	9.23	0		24	Pass
NVNT	802.11n(HT40)	5310	Ant 1	10.19	0	13.04	24	Pass
NVNT	802.11n(HT40)	5310	Ant 2	9.86	0		24	Pass

5.6G

Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Duty Factor (dB)	Total Power (dBm)	Limit (dBm)	Verdict
NVNT	802.11a	5500	Ant 1	10.23	0	-	24	Pass
NVNT	802.11a	5600	Ant 1	9.37	0	-	24	Pass
NVNT	802.11a	5700	Ant 1	9.12	0	-	24	Pass
NVNT	802.11a	5500	Ant 2	9.42	0	-	24	Pass
NVNT	802.11a	5600	Ant 2	9.64	0	-	24	Pass
NVNT	802.11a	5700	Ant 2	10.21	0	-	24	Pass
NVNT	802.11ac20	5500	Ant 1	11.13	0	13.16	24	Pass
NVNT	802.11ac20	5500	Ant 2	8.89	0		24	Pass
NVNT	802.11ac20	5600	Ant 1	10.29	0	12.79	24	Pass
NVNT	802.11ac20	5600	Ant 2	9.21	0		24	Pass
NVNT	802.11ac20	5700	Ant 1	10.1	0	13.00	24	Pass
NVNT	802.11ac20	5700	Ant 2	9.88	0		24	Pass
NVNT	802.11ac40	5510	Ant 1	10.71	0	12.75	24	Pass
NVNT	802.11ac40	5510	Ant 2	8.48	0		24	Pass
NVNT	802.11ac40	5590	Ant 1	9.64	0	12.29	24	Pass
NVNT	802.11ac40	5590	Ant 2	8.89	0		24	Pass
NVNT	802.11ac40	5670	Ant 1	10.07	0	12.70	24	Pass
NVNT	802.11ac40	5670	Ant 2	9.27	0		24	Pass
NVNT	802.11ac80	5530	Ant 1	10.33	0	12.42	24	Pass
NVNT	802.11ac80	5530	Ant 2	8.23	0		24	Pass
NVNT	802.11ac80	5610	Ant 1	9.91	0	12.35	24	Pass
NVNT	802.11ac80	5610	Ant 2	8.68	0		24	Pass
NVNT	802.11n(HT20)	5500	Ant 1	11.21	0	13.28	24	Pass
NVNT	802.11n(HT20)	5500	Ant 2	9.06	0		24	Pass
NVNT	802.11n(HT20)	5600	Ant 1	10.32	0	12.87	24	Pass
NVNT	802.11n(HT20)	5600	Ant 2	9.34	0		24	Pass
NVNT	802.11n(HT20)	5700	Ant 1	10.12	0	13.22	24	Pass
NVNT	802.11n(HT20)	5700	Ant 2	10.29	0		24	Pass
NVNT	802.11n(HT40)	5510	Ant 1	10.87	0	12.90	24	Pass
NVNT	802.11n(HT40)	5510	Ant 2	8.61	0		24	Pass
NVNT	802.11n(HT40)	5590	Ant 1	9.77	0	12.37	24	Pass
NVNT	802.11n(HT40)	5590	Ant 2	8.91	0		24	Pass
NVNT	802.11n(HT40)	5670	Ant 1	10.05	0	12.68	24	Pass
NVNT	802.11n(HT40)	5670	Ant 2	9.25	0		24	Pass

5.8G

Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Duty Factor (dB)	Total Power (dBm)	Limit (dBm)	Verdict
NVNT	802.11a	5745	Ant 1	10.04	0	-	30	Pass
NVNT	802.11a	5785	Ant 1	10.19	0	-	30	Pass
NVNT	802.11a	5825	Ant 1	11.39	0	-	30	Pass
NVNT	802.11a	5745	Ant 2	9.39	0	-	30	Pass
NVNT	802.11a	5785	Ant 2	9.86	0	-	30	Pass
NVNT	802.11a	5825	Ant 2	9.97	0	-	30	Pass
NVNT	802.11ac20	5745	Ant 1	8.96	0	12.12	30	Pass
NVNT	802.11ac20	5745	Ant 2	9.25	0		30	Pass
NVNT	802.11ac20	5785	Ant 1	10.2	0	13.03	30	Pass
NVNT	802.11ac20	5785	Ant 2	9.83	0		30	Pass
NVNT	802.11ac20	5825	Ant 1	11.51	0	13.82	30	Pass
NVNT	802.11ac20	5825	Ant 2	9.97	0		30	Pass
NVNT	802.11ac40	5755	Ant 1	9.37	0	12.50	30	Pass
NVNT	802.11ac40	5755	Ant 2	9.6	0		30	Pass
NVNT	802.11ac40	5795	Ant 1	10.31	0	12.99	30	Pass
NVNT	802.11ac40	5795	Ant 2	9.63	0		30	Pass
NVNT	802.11ac80	5775	Ant 1	9.65	0	12.58	30	Pass
NVNT	802.11ac80	5775	Ant 2	9.48	0		30	Pass
NVNT	802.11n(HT20)	5745	Ant 1	8.9	0	12.13	30	Pass
NVNT	802.11n(HT20)	5745	Ant 2	9.32	0		30	Pass
NVNT	802.11n(HT20)	5785	Ant 1	10.18	0	13.01	30	Pass
NVNT	802.11n(HT20)	5785	Ant 2	9.82	0		30	Pass
NVNT	802.11n(HT20)	5825	Ant 1	11.36	0	13.73	30	Pass
NVNT	802.11n(HT20)	5825	Ant 2	9.96	0		30	Pass
NVNT	802.11n(HT40)	5755	Ant 1	9.38	0	12.40	30	Pass
NVNT	802.11n(HT40)	5755	Ant 2	9.39	0		30	Pass
NVNT	802.11n(HT40)	5795	Ant 1	10.26	0	12.93	30	Pass
NVNT	802.11n(HT40)	5795	Ant 2	9.56	0		30	Pass

3 RF Exposure Evaluation

3.1 Operation in WLAN 2.4G

SISO

Antenna	Maximum output power (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm^2)	MPE Limit (mW/cm^2)	Conclusion
Ant 1	12.79	2	14.79	30.13	20	0.0060	1	Pass
Ant 2	15.06	2	17.06	50.82	20	0.0101	1	Pass

3.2 Operation in WLAN 5G

SISO

Antenna	Maximum output power (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm^2)	MPE Limit (mW/cm^2)	Conclusion
Ant 1	11.39	2	13.39	21.83	20	0.0043	1	Pass
Ant 2	10.58	2	12.58	18.11	20	0.0036	1	Pass

4 Exposure calculations for multiple sources

When a number of sources at different frequencies, and/or broadband sources, contribute to the total exposure, it becomes necessary to weigh each contribution relative to the MPE in accordance with the provisions of Table (A) and Table (B). To comply with the MPE, the fraction of the MPE in terms of E^2, H^2 (or power density) incurred within each frequency interval should be determined and the sum of all such fractions should not exceed unity.

In order to ensure compliance with the MPE for a controlled environment, the sum of the ratios of the power density to the corresponding MPE should not exceed unity. That is

$$\sum_{i=1}^{n} \frac{S_i}{MPE_i}$$

The product also has multiple transmitters The Simultaneous Transmission Possibilities are as below:

Simultaneous Tx Combination	Configuration
1	WLAN 2.4G MIMO
2	WLAN 5.2G MIMO
3	WLAN 5.3G MIMO
4	WLAN 5.6G MIMO
5	WLAN 5.8G MIMO

4.1 Estimation for WLAN2.4G MIMO

Antenna	Tune-up limit (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm^2)	MPE Limit (mW/cm^2)	Calculation result	Conclusion
Ant 1	12.85	2	14.85	30.55	20	0.0061	1	0.0158	Pass
Ant 2	14.88	2	16.88	48.75	20	0.0097	1		

4.2 Estimation for WLAN5G MIMO

Antenna	Tune-up limit (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm^2)	MPE Limit (mW/cm^2)	Calculation result	Conclusion
Ant 1	11.51	2	13.51	22.44	20	0.0045	1	0.0076	Pass
Ant 2	9.97	2	11.97	15.74	20	0.0031	1		

According to the Table above, we can conclude that the calculation results of all simultaneous transmission possibilities are less than 1, so it is into compliance.
Therefore the product also meets the requirements under multiple sources condition.

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