



SPORTON International Inc.

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Project No: CB10506007

Maximum Permissible Exposure Report

Applicant's company	Roku, Inc.
Applicant Address	150 Winchester Circle, Los Gatos, CA 95032
FCC ID	TC2-N1002
Manufacturer's company (1)	Life-On Network Communication (Dongguan) Limited
Manufacturer Address	30#Keji Rd., Yin Hu Industrial Area, Qingxi Town, DongGuan City, Guangdong, China
Manufacturer's company (2)	LITE-ON TECHNOLOGY (Changzhou) CO., LTD
Manufacturer Address	A9 Building, No.88 Yanghu Road, Wujin Hi-Tech Industrial Development Zone, Changzhou City, Jiangsu Province 213100 China

Product Name	2 x 2 Wi-Fi Module
Brand Name	Roku
Model Name	WM03, WM04
Ref. Standard(s)	47 CFR FCC Part 2 Subpart J, section 2.1091
Received Date	Jan. 20, 2014
Final Test Date	Jun. 06, 2016
Submission Type	Class II Change



Sam Chen

SPORTON INTERNATIONAL INC.



Table of Contents

1. GENERAL DESCRIPTION.....	1
1.1. EUT General Information	1
1.2. Table for Multiple List.....	1
1.3. Table for Class II Change	2
1.4. Testing Location.....	3
2. MAXIMUM PERMISSIBLE EXPOSURE.....	4
2.1. Limit of Maximum Permissible Exposure	4
2.2. MPE Calculation Method	5
2.3. Calculated Result and Limit.....	5

History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA412906-02	Rev. 01	Initial issue of report	Jul. 14, 2016

1. GENERAL DESCRIPTION

1.1. EUT General Information

RF General Information			
Evaluation Mode	Frequency Range (MHz)	Operating Frequency (MHz)	Modulation Type
2.4GHz WLAN	2400-2483.5	2412-2462	802.11b: DSSS (DBPSK, DQPSK, CCK) 802.11g/n: OFDM (BPSK, QPSK, 16QAM, 64QAM)
5GHz WLAN	5150-5250 5725-5850	5180-5240 5745-5825	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM)

Note: The EUT supports 20MHz only.

1.2. Table for Multiple List

The model names in the following table are all refer to the identical product.

Brand Name	EUT	Model Name	SKU	Metal Ring	Photo
Roku	EUT 1	WM03	6Pin connector	V	
	EUT 2		8Pin connector	V	
	EUT 3	WM04	6Pin connector	X	

1.3. Table for Class II Change

This product is an extension of original one reported under Sporton project number: FA412906

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
Updating Manufacturer Name and Address. Adding four same type antennas with lower gain (model: 30100007416D, 3010000844HD, 30100007826D and 3010000845HD). Removing Chain 2 connector. Adding a latch connector for model: WM03 (8pin) /WM04.	Do not effect the test results.
Adding P10 second source for S1015-08RVB-SB3-KH for model: WM03/WM04. Adding the components R195, TP32 for model: WM03. Removing the components from R209, R200 for model: WM03. Adding 8Pin connector for model: WM03.	After evaluating, it's not necessary to re-test Maximum Permissible Exposure.
Updating 5GHz Band 1 to "New Rules" from "Old Rules".	
Updating test rule of 5GHz band 4 to "15.407 (b)(4)(i) of New Rules (ET Docket No. 13-49; FCC 16-24)" from "Old Rules".	Maximum Permissible Exposure.

Note: Maximum Permissible Exposure of 2.4GHz and 5GHz Band1 is based on original report.

1.4. Testing Location

Testing Location		
☐	HWA YA	ADD : No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL : 886-3-327-3456 FAX : 886-3-327-0973
☒	JHUBEI	ADD : No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C. TEL : 886-3-656-9065 FAX : 886-3-656-9085

2. MAXIMUM PERMISSIBLE EXPOSURE

2.1. Limit of Maximum Permissible Exposure

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

2.2. MPE Calculation Method

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = Peak RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

2.3. Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

For 5GHz Band 1:

Antenna Type : PIFA Antenna

Conducted Power for IEEE 802.11n HT20: 16.33dBm

Distance (cm)	Test Freq. (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
20	5180	4.26	2.6669	16.3312	42.9658	0.022807	1	Complies

For 5GHz Band 4:

Antenna Type : PIFA Antenna

Conducted Power for IEEE 802.11n HT20: 21.18dBm

Distance (cm)	Test Freq. (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
20	5785	4.26	2.6669	21.18	131.0992	0.0695	1	Complies

For 2.4GHz Band:

Antenna Type : PIFA Antenna

Conducted Power for IEEE 802.11n HT20: 23.35dBm

Distance (cm)	Test Freq. (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
20	2437	3.53	2.2542	23.3459	216.0663	0.096948	1	Complies