RF Exposure Evaluation Declaration

Product Name	:	IP-STB
Model No.	:	3600X
IC	:	20842-3600X

Applicant	:	Roku Inc.
Address	:	12980 Saratoga Ave, Suite D Saratoga, CA 95070

Date of Receipt	:	Dec. 25, 2015
Issued Date	:	Jan.19 , 2016
Report No.	:	15C2073R-RF-CA-P20V01
Report Version	:	V1.0

Test Report Certification

Issued Date : Jan. 19, 2016
Report No. : 15C2073R-RF-CA-P20V01

Product Name	:	IP-STB
Applicant	:	Roku Inc.
Address	:	12980 Saratoga Ave, Suite D Saratoga, CA 95070
Manufacturer	:	Ambit Mircosystems (Shanghai) LTD.
Address	:	1925, Nanle Road, Songjiang Export Processing Zone, Shanghai, China 201613
Model No.	:	3600X
IC	:	5959A-RCB8
EUT Voltage	::	DC 5V
Brand Name	:	Roku
Applicable Standard	:	RSS-102: Issue 5, 2015
Test Result	:	Complied
Performed Location	:	Suzhou EMC Laboratory No.99 Hongye Rd., Suzhou Industrial Park, Suzhou, 215006, Jiangsu, China TEL: +86-512-6251-5088 / FAX: +86-512-6251-5098 IC Lab Code: 4075B

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(Senior Engineer: Frank He)

Approved By : Harry Zhao

(Engineering Manager : Harry Zhao)

Laboratory Information

We, **QuieTek Corporation**, are an independent EMC and safety consultancy that was established the whole facility in our laboratories. The test facility has been accredited/accepted(audited or listed) by the following related bodies in compliance with ISO 17025, EN 45001 and specified testing scope:

Taiwan R.O.C.	**:**	**BSMI, NCC, TAF**
USA	**:**	**FCC**
Japan	**:**	**VCCI**
China	**:**	**CNAS**

The related certificate for our laboratories about the test site and management system can be downloaded from QuieTek Corporation's Web Site : http://www.quietek.com/english/about/certificates.aspx?bval=5
The address and introduction of QuieTek Corporation's laboratories can be founded in our Web site : http://www.quietek.com/index_en.aspx
If you have any comments, Please don't hesitate to contact us. Our contact information is as below:

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TEL : +86-512-6251-5088 / FAX : 86-512-6251-5098 E-Mail : service@quietek.com

History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
15C2073R-RF-CA-P20V01	V1.0	Initial Issued Report	Jan. 19, 2016

1. RF Exposure Evaluation

1.1. Limits

According to RSS 102 Issue 5: 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 RSS 102 Clause 4

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
$0.003\text{-}10^{21}$	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142f^{0.3417}$	$0.008335f^{0.3417}$	$0.02619f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

F= Frequency in MHz

Friis Formula

Friis transmission formula: Pd = (Pout*G)/(4*pi*r2)

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 id the limit of MPE, 0.535 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℃and 78％ RH.

1.3. Test Result of RF Exposure Evaluation

Product	:	IP-STB
Test Item	:	RF Exposure Evaluation
Test Site	:	AC-6

- Antenna Gain:

Antenna List

Antenna No.	Manufacturer	Model No.	Peak Gain	Directional Gain
Antenna 1	TDK-EPC Corporation	ANT016008LCD2442MA1	2.38dBi for 2.4GHz 5.54dBi for 5GHz	5.39dBi for 2.4GHz 8.55dBi for 5GHz
Antenna 2	TDK-EPC Corporation	ANT016008LCD2442MA1	2.38dBi for 2.4GHz 5.54dBi for 5GHz	

Not: Directional gain = GANT + 10 log(NANT) dBi

Note: 1: The EUT has two WIFI antennas, and each port has same gain, they transmit signals are correlated with each other.

(1) 2.4G WIFI Directional gain for Calculation is:

Directional gain = GANT + Array Gain≈5.39dBi

(2) 5G WIFI Directional gain for Calculation is:

Directional gain = GANT + Array Gain≈8.55dBi

- Output Power into Antenna & RF Exposure Evaluation Distance:

Standlone modes

2.4GHz:

Test Mode	Frequency Band (MHz)	Maximum Output Power to Antenna (dBm)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm2)
802.11b	2412 - 2462	21.85	2.38	0.052690
802.11g	2412 - 2462	21.74	2.38	0.051372
802.11n(20MHz)	2412 - 2462	21.95	2.38	0.053918
802.11n(40MHz)	2422 - 2452	24.61	5.39	0.198944

5GHz:

Test Mode	Frequency Band (MHz)	Maximum Output Power to Antenna (dBm)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm2)
802.11a	5180 - 5240	16.48	5.54	0.031676
	5745 - 5825	15.95	5.54	0.028037
802.11n(20MHz)	5180 - 5240	17.49	8.55	0.079934
	5745 - 5825	17.52	8.55	0.080488
802.11n(40MHz)	5190 - 5230	19.39	8.55	0.123803
	5755 - 5795	15.83	8.55	0.054542

Simultaneous transmission:

Test Mode	Frequency Band (MHz)	Maximum Output Power to Antenna (dBm)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm2)
802.11n(40MHz)	2422 - 2452	24.61	5.39	0.198944
802.11n(40MHz)	5190 - 5230	19.39	8.55	0.123803
Simultaneous transmission power density				0.322747

So according to transmission formula: Pd = (Pout*G)/(4*pi*r^2) and the power density limit according to RSS 102 Issue 5, the limit is 0.535 mW/cm^2

Safety Distance Calculation Formula:

The power flux:

$$S = \frac{P*G_{(\theta,\phi)}}{4*\pi*r^2}$$

So safety distance as following:

$$r = \sqrt{\frac{P*G}{4*\pi*S}}$$

P = input power of the antenna

G = antenna gain relative to an isotropic antenna

θ, Φ = elevation and azimuth angles.

r = distance from the antenna to the point of investigation

Test Mode	Frequency Range (MHz)	Maximum EIRP (dBm)	Limit of Power Density S(mW/cm^2)	Safety Distance r(cm)
802.11n(40MHz)	2422 - 2452	30.00	0.535	15.53
802.11n(40MHz)	5190 - 5230	27.94	0.883	

Note: The safety distance is 15.53cm for the router without any other radio equipment.

The End