RF EXPOSURE REPORT

Report No.: 17070869-FCC-H

Applicant	Humax Co., Ltd.
Product Name	Wi-Fi Router
Model No.	QUANTUM T9x (WLAN 2G : 3T3R, 5G : 4T4R)
Serial No.	QUANTUM T7x(WLAN 2G : 3T3R, 5G : 3T3R);QUANTUM T5x(WLAN 2G : 2T2R, 5G : 3T3R)
Test Standard	FCC 2.1091: 2016
Test Date	September 13 to December 11, 2017
Issue Date	December 11, 2017
Test Result	☑ Pass ☐ Fail
Equipment complied with the specification	☑
Equipment did not comply with the specification	☐

Aaron Liang	David Huang	
Aaron Liang Test Engineer	David Huang Checked By	

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Test result presented in this test report is applicable to the tested sample only

Issued by:

SIEMIC (SHENZHEN-CHINA) LABORATORIES

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Laboratories Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.

In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Scope
USA	EMC, RF/Wireless, SAR, Telecom
Canada	EMC, RF/Wireless, SAR, Telecom
Taiwan	EMC, RF, Telecom, SAR, Safety
Hong Kong	RF/Wireless, SAR, Telecom
Australia	EMC, RF, Telecom, SAR, Safety
Korea	EMI, EMS, RF, SAR, Telecom, Safety
Japan	EMI, RF/Wireless, SAR, Telecom
Singapore	EMC, RF, SAR, Telecom
Europe	EMC, RF, SAR, Telecom, Safety

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1. Report Revision History

Report No.	Report Version	Description	Issue Date
17070869-FCC-H	NONE	Original	December 11, 2017

2. Customer information

Applicant Name	Humax Co., Ltd.
Applicant Add	HUMAX Village, 11-4, Sunae-dong, Bundang-gu,Seongnam city, Gyeonggi-do , South Korea 463-825
Manufacturer	Humax Co., Ltd.
Manufacturer Add	HUMAX Village, 11-4, Sunae-dong, Bundang-gu,Seongnam city, Gyeonggi-do , South Korea 463-825

3. Test site information

Lab performing tests	SIEMIC (Shenzhen-China) LABORATORIES
Lab Address	Zone A, Floor 1, Building 2 Wan Ye Long Technology Park South Side of Zhoushi Road, Bao' an District, Shenzhen, Guangdong China 518108
FCC Test Site No.	535293
IC Test Site No.	4842E-1
Test Software	Labview of SIEMIC version 2.0

4. Equipment under Test (EUT) Information

Description of EUT:	Wi-Fi Router
Main Model:	QUANTUM T9x (WLAN 2G : 3T3R, 5G : 4T4R)
Serial Model:	QUANTUM T7x(WLAN 2G : 3T3R, 5G : 3T3R);QUANTUM T5x(WLAN 2G : 2T2R, 5G : 3T3R)
Equipment Category :	DTS
Antenna Gain:	WIFI(2.4G): Antenna (White): 3.5 dBi Antenna (Blue): 3.5 dBi Antenna (Black): 3.5 dBi WIFI(5150-5250MHz): Antenna (Gray): 4.5 dBi Antenna (Black): 4.5 dBi Antenna (Blue): 4.5 dBi Antenna (White): 4.5 dBi WIFI(5725-5875MHz): Antenna (Gray): 4.5 dBi Antenna (Black): 4.5 dBi Antenna (Blue): 4.5 dBi Antenna (White): 4.5 dBi
Antenna type :	Dipole antenna
Input Power:	Battery: Model: ADS-30FD-12 12030E INPUT: AC 100-240V~50/60Hz, Max. 0.8A OUTPUT: 12V, 2.5A
Trade Name :	N/A
FCC ID:	O6ZT9X
Type of Modulation:	802.11b: DSSS 802.11g/n20/n40/a/ac20/ac40/ac80: OFDM

RF Operating Frequency (ies):	WIFI: 802.11b/g: 2412-2462 MHz(TX/RX) WIFI: 802.11n(20M): 2412-2462 MHz; 5180-5240 MHz; 5745-5825 MHz；(TX/RX) WIFI: 802.11n(40M): 2422-2452 MHz; 5190-5230 MHz; 5755-5795 MHz (TX/RX) 802.11a: 5180-5240 MHz;5745-5825 MHz； (TX/RX) 802.11ac 20: 5180-5240 MHz;5745-5825 MHz； (TX/RX) 802.11ac 40: 5190-5230 MHz;5755-5795 MHz；(TX/RX) 802.11ac 80: 5210 MHz; 5775 MHz； (TX/RX)
Number of Channels:	WIFI :802.11b/g/n(20M): 11CH WIFI :802.11n(40M): 7CH WIFI :802.11a: 9CH WIFI :802.11ac20: 9CH WIFI :802.11ac40: 4CH WIFI :802.11ac80: 1CH

5. FCC §2.1091 - Maximum Permissible exposure (MPE)

5.1 Applicable Standard

According to §1.1307(b)(1), 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 level in excess of the Commission' s guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
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
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

5.2 Test Result

Mode	Antenna Path	Channel	Antenna (White) Conducted Powe (dBm)	Antenna (Blue) Conducted Powe (dBm)	Antenna (Black) Conducted Powe (dBm)	The Highest (SISO) or Total (MIMO) Conducted Power (dBm)	Tune Up Power (dBm)
b	SISO	1	20.97	20.97	21.97	21.97	22.0+/-1
		6	21.57	20.97	21.97	21.97	22.0+/-1
		11	21.57	21.07	21.97	21.97	22.0+/-1
g	SISO	1	18.23	17.93	17.33	18.23	18.0+/-1
		2	20.03	20.53	21.23	21.23	21.0+/-1
		3	22.43	22.23	23.03	23.03	23.0+/-1
		6	22.33	22.23	23.03	23.03	23.0+/-1
		9	22.33	22.33	23.03	23.03	23.0+/-1
		10	22.33	22.13	21.63	22.33	22.0+/-1
		11	18.73	17.53	19.43	19.43	19.5+/-1
n(HT20)	MIMO (3TX White+ Blue+ Black)	1	13.7	13.2	15.3	18.93	19.0+/-1
		2	18.9	18.2	19.6	23.71	23.5+/-1
		6	18.3	18.2	19.4	23.44	23.5+/-1
		11	15.9	15.7	16.7	20.89	20.5+/-1
N(HT40)	MIMO (3TX White+ Blue+ Black)	3	13.2	12.9	14	18.16	18.0+/-1
		4	13.2	12.9	13.7	18.05	18.0+/-1
		5	16.2	16	16.3	20.94	21.0+/-1
		6	16.5	16.4	16.6	21.27	21.0+/-1
		7	16.3	16.4	16.5	21.17	21.0+/-1
		8	14.8	14.8	15.2	19.71	19.5+/-1
		9	14.7	14	14.6	19.22	19.5+/-1

5150-5250MHz

Mode	Antenna Path	Channel	Antenna (Gray)	Antenna (Black)	Antenna (Blue)	Antenna (White)	The Highest (SISO) or Total (MIMO) conducted power	Tune Up Power (dBm))
			Averaged Conducted Power (dBm)	Averaged Conducted Power (dBm)	Averaged Conducted Power (dBm)	Averaged Conducted Power (dBm)		
a	SISO	5180	21.03	21.43	21.73	21.53	21.73	22.0+/-1
		5220	21.13	21.43	21.93	21.63	21.93	22.0+/-1
		5240	21.23	21.33	21.93	21.53	21.93	22.0+/-1
n20	MIMO (4TX Gray+ Black+ Blue+ White)	5180	12.5	12.7	13	13.1	18.85	18.5+/-1
		5220	12.5	12.8	13	13.1	18.88	18.5+/-1
		5240	12.4	12.2	12.5	13.1	18.58	18.5+/-1
n40	MIMO (4TX Gray+ Black+ Blue+ White)	5190	12.17	12.37	12.87	12.67	18.55	18.5+/-1
		5230	12.37	12.37	12.87	12.87	18.65	18.5+/-1
ac20	MIMO (4TX Gray+ Black+ Blue+ White)	5180	12.6	12.5	13.2	13.1	18.88	18.5+/-1
		5220	12.5	12.4	13.1	13	18.78	18.5+/-1
		5240	12.4	12.1	12.5	12.4	18.37	18.5+/-1
ac40	MIMO (4TX Gray+ Black+ Blue+ White)	5190	12.17	12.27	12.97	12.87	18.6	18.5+/-1
		5230	12.37	12.27	12.87	12.87	18.62	18.5+/-1
ac80	MIMO (4TX Gray+ Black+ Blue+ White)	5210	15.48	15.28	15.78	15.78	21.61	21.5+/-1

5725-5825MHz:

Mode	Antenna Path	Channel	Antenna (Gray)	Antenna (Black)	Antenna (Blue)	Antenna (White)	The Highest (SISO) or Total (MIMO) conducted power	Tune Up Power (dBm))
			Averaged Conducted Power (dBm)	Averaged Conducted Power (dBm)	Averaged Conducted Power (dBm)	Averaged Conducted Power (dBm)		
a	SISO	5745	23.33	22.83	22.83	22.83	23.33	23.0+/-1
		5785	23.23	22.53	22.73	22.93	23.23	23.0+/-1
		5825	23.03	22.03	22.63	22.73	23.03	23.0+/-1
n20	MIMO (4TX Gray+ Black+ Blue+ White)	5745	19.7	17.9	18.8	18.6	24.82	24.5+/-1
		5785	19.7	17.8	18.8	18.5	24.77	24.5+/-1
		5825	19.6	17.4	18.6	18.4	24.59	24.5+/-1
n40	MIMO (4TX Gray+ Black+ Blue+ White)	5755	19.1	17.5	18.3	18.1	24.31	24.5+/-1
		5795	19.2	17.3	18.2	18	24.25	24.5+/-1
ac20	MIMO (4TX Gray+ Black+ Blue+ White)	5745	19.7	18	18.8	18.4	24.79	24.5+/-1
		5785	19.8	17.9	18.8	18.5	24.83	24.5+/-1
		5825	19.6	17.8	18.6	18.4	24.67	24.5+/-1
ac40	MIMO (4TX Gray+ Black+ Blue+ White)	5755	19.1	17.6	18.3	18.1	24.33	24.5+/-1
		5795	19.2	17.4	18.3	18	24.29	24.5+/-1
ac80	MIMO (4TX Gray+ Black+ Blue+ White)	5775	18.88	17.58	18.18	18.08	24.23	24.5+/-1

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

Where: S = power density (in appropriate units, e.g. mW/cm^2)

P = power input to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

2.4G WIFI:

For the antenna manufacturer provide only used limited to ERP/EIRP or radiated spurious emission test. The MPE evaluation as below:

Maximum output power at antenna input terminal: 24.5(dBm)

Maximum output power at antenna input terminal: 281.838(mW)

Prediction distance: >20 (cm)

Predication frequency: 2437 (MHz) middle frequency

Antenna Gain (typical):3.5 (dBi)

Antenna Gain (typical):2.239 (numeric)

The worst case is power density at predication frequency at 20 cm: 0.126(mW/cm^2)

5G WIFI:

For the antenna manufacturer provide only used limited to ERP/EIRP or radiated spurious emission test. The MPE evaluation as below:

Maximum output power at antenna input terminal: 25.5(dBm)

Maximum output power at antenna input terminal: 354.81(mW)

Prediction distance: >20 (cm)

Predication frequency: 5825 (MHz) High frequency

Antenna Gain (typical):4.5 (dBi)

Antenna Gain (typical):2.818 (numeric)

The worst case is power density at predication frequency at 20 cm: 0.199(mW/cm^2)

Because 2.4G WIFI and 5G WIFI bands can be operate simultaneously, the total power density of 2.4G and 5G WIFI is 0.325mW/cm^2

MPE limit for general population exposure at prediction frequency: 1 (mW/cm^2)

0.325(mW/cm^2) < 1.0 (mW/cm^2)

Result: Pass