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

KDB 447498 D01

Product Name： MyWirelessTV3 Wireless HD Receiver
4K Wireless HD Connection Kit

Trademark： Actiontec

Model Name： MWTV3RX

Serial Model： MWTV3KIT

Report No.： NTEK-2017NT08175780HF

FCC ID： **LNQMWTV3RX**

Prepared for

Actiontec Electronics,Inc.

760 North Mary Ave., Sunnyvale, CA 94085 USA

Prepared by

Shenzhen NTEK Testing Technology Co., Ltd.

1/F, Building E, Fenda Science Park, Sanwei Community, Xixiang Street, Bao'an District, Shenzhen 518126 P.R.China.
Tel.: +86-755-6115 9388   Fax.: +86-755-6115 6599
Website: http://www.ntek.org.cn

TEST RESULT CERTIFICATION

Applicant's name................. : Actiontec Electronics,Inc.

Address .... : 760 North Mary Ave., Sunnyvale, CA 94085 USA

Manufacturer's Name .... : Actiontec Electronics,Inc.

Address .... : 760 North Mary Ave., Sunnyvale, CA 94085 USA

Product description

Product name .... :   MyWirelessTV3 Wireless HD Receiver
                                         4K Wireless HD Connection Kit

Trademark .... : Actiontec

Model and/or type reference : MWTV3RX

Serial Model .... : MWTV3KIT

Standards............................. :   FCC 47 CFR Part 1(1.1310)
                                          FCC 47 CFR Part 2(2.1091)
                                          ANSI/IEEE C95.1-1992
                                          KDB 447498 D01

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 ....: 17 Aug. 2017 ~ 13 Sep. 2017

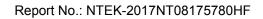Date of Issue .... : 13 Sep. 2017

Test Result.. : **Pass**

Prepared By
(Test Engineer)   :   *Eileen Wu.*
                                    (Cheng Jiawen)

Approved By
(Lab Manager)   :   *Sam Chen*
                                    (Sam Chen)

※ ※ Revision History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	Aug. 17, 2017	Cheng Jiawen

TABLE OF CONTENTS

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/cm²)	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/f²	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/f²	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/cm²)

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	MyWirelessTV3 Wireless HD Receiver 4K Wireless HD Connection Kit
Trade Name	Actiontec
Model Name	MWTV3RX
Serial Model	MWTV3KIT
FCC ID	LNQMWTV3RX
Device Phase	Identical Prototype
Exposure Category	General population / Uncontrolled environment
Antenna Type	See Note 1
Antenna Gain	See Note 1
Device Operating Configurations	
IEEE 802.11 WLAN Mode Supported	☒802.11a/AC(20MHz channel bandwidth) ☒802.11n/AC(20MHz channel bandwidth) ☒802.11n/AC(40MHz channel bandwidth) ☒802.11AC(80MHz channel bandwidth)
Modulation	OFDM with BPSK/QPSK/16QAM/64QAM/256QAM for 802.11a/n/ac;
Smart system	☒SISO for 802.11a ☒MIMO for 802.11n/ac
Operating Frequency Range	☒5180-5240MHz for 802.11a/n(HT20)/ac20; 5190-5230MHz for 802.11n(HT40)/ac40; 5210MHz for 802.11 ac80; ☒5745-5825 MHz for 802.11a/n(HT20)/ac20; 5755-5795 MHz for 802.11a/n(HT40)/ac40; 5775MHz for 802.11 ac80;

Note 1:

 The EUT has two types of antenna.

Antenna	Brand	Model Name (P/N)	Antenna Type	Connector	Antenna Gain(dBi)	
					5.2G	5.8G
A(main)	Wha Yu	C787-510136-A (X6)	Dipole(PCB)	I-PEX	3.6	3.2
B(aux)	Wha Yu	C787-510137-A (X5)	Dipole(PCB)	I-PEX	4.5	5.8

For MIMO mode , Directional gain=$[10\log(G_A+ G_B)]$ dbi =7.08dbi in 5.2GHz

Directional gain=$[10\log(G_A+ G_B)]$ dbi =7.70dbi in 5.8GHz

802.11n/ac 5GHz has MIMO mode.

 Note: G_A means antenna gain for ANT A in Num.

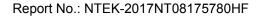 G_B means antenna gain for ANT B in Num.

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

1.4   Ambient Condition

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

2　RF Output Power

2.1　Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
Agilent	Power Meter	DARE/ RPR3006W	15I00041SNO84	2017.08.09	2018.08.08

2.2　RF Output Power

2.2.1　WIFI Output Power

5.2G WIFI:

Test Channel	Frequency	Maximum output power. Antenna port (AV) (dBm)		Total Power (AV)	Tune-up (dBm)		Max Tune-up (dBm)	
	(MHz)	ANT A	ANT B	dBm	ANT A	ANT B	ANT A	ANT B
TX 802.11a Mode								
CH36	5180	16.15	16.28	−	17±1	17±1	18	18
CH40	5200	16.54	16.33	−	17±1	17±1	18	18
CH48	5240	17.35	16.93	−	17±1	17±1	18	18
TX 802.11 n20M Mode								
CH36	5180	12.71	12.75	15.74	13±1	13±1	14	14
CH40	5200	12.79	12.84	15.83	13±1	13±1	14	14
CH48	5240	13.66	13.30	16.49	13±1	13±1	14	14
TX 802.11 n40M Mode								
CH38	5190	14.74	14.04	17.41	14±1	14±1	15	15
CH46	5230	14.68	14.22	17.47	14±1	14±1	15	15
TX 802.11 AC20M Mode								
CH36	5180	12.67	12.17	15.44	13±1	13±1	14	14
CH40	5200	13.16	12.66	15.93	13±1	13±1	14	14
CH48	5240	13.86	12.56	16.27	13±1	13±1	14	14
TX 802.11 AC40M Mode								
CH38	5190	14.82	14.57	17.71	15±1	15±1	16	16
CH46	5230	15.36	15.37	18.38	15±1	15±1	16	16
TX 802.11 AC80M Mode								
CH42	5210	14.75	13.12	17.02	14±1	14±1	15	15

5.8G WIFI:

Test Channel	Frequency	Maximum output power. Antenna port (AV) (dBm)		Total Power (AV)	Tune-up (dBm)		Max Tune-up (dBm)	
	(MHz)	ANT A	ANT B	dBm	ANT A	ANT B	ANT A	ANT B
TX 802.11a Mode								
CH 149	5745	18.5	18.2	−	18±1	18±1	19	19
CH 157	5785	18.4	18.0	−	18±1	18±1	19	19
CH 165	5825	18.1	18.0	−	18±1	18±1	19	19
TX 802.11 n20M Mode								
CH 149	5745	18.7	18.5	21.61	18±1	18±1	19	19
CH 157	5785	18.5	18.1	21.31	18±1	18±1	19	19
CH 165	5825	18.4	18.6	21.51	18±1	18±1	19	19
TX 802.11 n40M Mode								
CH 151	5755	17.7	17.9	20.81	18±1	18±1	19	19
CH 159	5795	17.8	18.2	21.01	18±1	18±1	19	19
TX 802.11 AC20M Mode								
CH 149	5745	18.6	18.4	21.51	18±1	18±1	19	19
CH 157	5785	18.4	18.2	21.31	18±1	18±1	19	19
CH 165	5825	18.5	18.7	21.61	18±1	18±1	19	19
TX 802.11 AC40M Mode								
CH 151	5755	17.9	18.0	20.96	18±1	18±1	19	19
CH 159	5795	18.0	18.1	21.06	18±1	18±1	19	19
TX 802.11 AC80M Mode								
CH 155	5775	17.6	17.4	20.51	17±1	17±1	18	18

3 RF Exposure Evaluation

3.1 Operation in WLAN 5.2G FOR SISO MODE

ANT A:

Max Tune-up (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm^2)	MPE Limit (mW/cm^2)	Conclusion
18.00	3.6	21.6	144.54	20	0.0288	1.000	Pass

ANT B:

Max Tune-up (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm^2)	MPE Limit (mW/cm^2)	Conclusion
18.00	4.5	22.5	177.83	20	0.0354	1.000	Pass

3.2 Operation in WLAN 5.8G FOR SISO MODE

ANT A

Tune-up limit (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm^2)	MPE Limit (mW/cm^2)	Conclusion
19.00	3.2	22.2	165.96	20	0.0330	1.000	Pass

ANT B

Tune-up limit (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm^2)	MPE Limit (mW/cm^2)	Conclusion
19.00	5.8	24.8	302.00	20	0.0601	1.000	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 MIMO

4.1 Estimation for WLAN MIMO 5.2G

ANT	Max Tune-up (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm^2)	Total S (mW/cm^2)	MPE Limit (mW/cm^2)	Conclusion
A	16.00	3.6	19.6	91.201	20	0.0181	0.0404	1.000	Pass
B	16.00	4.5	20.5	112.202		0.0223			

4.2 Estimation for WLAN MIMO 5.8G

ANT	Max Tune-up (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm^2)	Total S (mW/cm^2)	MPE Limit (mW/cm^2)	Conclusion
A	19.00	3.2	22.2	165.959	20	0.0330	0.0931	1.000	Pass
B	19.00	5.8	24.8	301.995		0.0601			

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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