



No. 1 Workshop, M-10, Middle section, Science & Technology Park,
Shenzhen, Guangdong, China 518057

Telephone: +86 (0) 755 2601 2053
Fax: +86 (0) 755 2671 0594
Email: ee.shenzhen@sgs.com

Report No.: SZEM170500450306
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RF Exposure Evaluation Report

Application No.: SZEM1705004503CR
Applicant: Sichuan Changhong Network Technologies Co., Ltd.
Address of Applicant: Science and Technology Park, Mianyang City, Sichuan Province, China
Manufacturer: Sichuan Changhong Network Technologies Co., Ltd.
Address of Manufacturer: Science and Technology Park, Mianyang City, Sichuan Province, China
Factory: Sichuan Changhong Network Technologies Co., Ltd.
Address of Factory: No. 49 North HuoJu West Street, high-tech park, mianyang, sichuan, china
Equipment Under Test (EUT):
EUT Name: Network Set-Top Box
Model No.: IHO-4000 I
Trade mark: FREEDOCAST
FCC ID: 2AIFQIHO-4000I
Standards: 47 CFR Part 1.1307
 47 CFR Part 1.1310
 KDB447498D01 General RF Exposure Guidance v06
Date of Receipt: 2017-05-15
Date of Test: 2017-05-19 to 2017-06-20
Date of Issue: 2017-07-14

Test Result :	PASS*
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* In the configuration tested, the EUT complied with the standards specified above.



Jack Zhang
EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.

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2 Version

<i>Revision Record</i>				
<i>Version</i>	<i>Chapter</i>	<i>Date</i>	<i>Modifier</i>	<i>Remark</i>
01		2017-07-14		Original

Authorized for issue by:				
		<i>Edison Li</i>		
		Edison Li /Project Engineer		
		<i>Eric Fu</i>		
		Eric Fu /Reviewer		



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4 General Information

4.1 General Description of EUT

Power Supply:	DC 7.2V, 2600mAh rechargeable lithium-ion battery which charged by AC/DC adapter 3.0V DC(1.5V x 2 "AAA" Size Batteries) for remote controller AC/DC Adapter Model: GSCU1500S012V18N Input: AC 100-240V, 50/60Hz, 0.5A Max Output: DC 12V, 1.5A
Cable:	DC cable: 150cm unshielded Network cable: 147cm unshielded HDMI cable: 142cm unshielded
For BT:	
Frequency Range:	2402MHz to 2480MHz
Bluetooth Version:	V4.0 Dual mode
	This is for classic mode.
Spectrum Spread Technology:	Frequency Hopping Spread Spectrum(FHSS)
Hopping Channel Type:	Adaptive Frequency Hopping systems
Modulation Type:	GFSK, $\pi/4$ DQPSK, 8DPSK
Number of Channels:	79
Sample Type:	Fixed device
Antenna Type:	Integral
Antenna Gain:	3dBi
For BLE:	
Frequency Range:	2402MHz to 2480MHz
Bluetooth Version:	V4.0 Dual mode
	This is for BLE mode.
Modulation Type:	GFSK
Number of Channels:	40
Sample Type:	Fixed device
Antenna Type:	Integral
Antenna Gain:	3dBi



For 2.4G Wifi:				
Operation Frequency:	IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz IEEE 802.11n(HT40): 2422MHz to 2452MHz			
Modulation Type:	IEEE for 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE for 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE for 802.11n(HT20 and HT40): OFDM (BPSK, QPSK, 16QAM, 64QAM)			
Channel Numbers:	IEEE 802.11b/g, IEEE 802.11n HT20: 11 Channels IEEE 802.11n HT40: 7 Channels			
Sample Type:	Fixed device			
Antenna Type:	Integral			
Antenna Gain:	Antenna 1/Antenna 2: 3dBi Note: MIMO for 802.11n			
For 5G Wifi:				
Operation Frequency:	Band	Mode	Frequency Range(MHz)	Number of channels
	UNII Band I	IEEE 802.11a/n(HT20)	5180-5240	4
		IEEE 802.11n(HT40)	5190-5230	2
	UNII Band II-A	IEEE 802.11a/n(HT20)	5260-5320	4
		IEEE 802.11n(HT40)	5270-5310	2
	UNII Band II-C	IEEE 802.11a/n(HT20)	5500-5700	11
		IEEE 802.11n(HT40)	5510-5670	5
	UNII Band III	IEEE 802.11a/n(HT20)	5745-5825	5
		IEEE 802.11n(HT40)	5755-5795	2
Modulation Type:	IEEE 802.11a: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM)			
DFS Function:	Slave without radar detection			
Sample Type:	Fixed device			
Antenna Type:	Integral			
Antenna Gain:	Antenna 1/ Antenna 2: 3dBi Note: MIMO for 802.11n			



4.2 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch E&E Lab

No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China
518057

Telephone: +86 (0) 755 2601 2053 Fax: +86 (0) 755 2671 0594

No tests were sub-contracted.

4.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

- **VCCI**

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-823, R-4188, T-1153 and C-2383 respectively.

- **FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

- **Industry Canada (IC)**

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.

4.4 Deviation from Standards

None.

4.5 Abnormalities from Standard Conditions

None.

4.6 Other Information Requested by the Customer

None.

5 RF Exposure Evaluation

5.1 RF Exposure Compliance Requirement

5.1.1 Limits

According to FCC Part1.1310: 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 part1.1307(b)

TABLE 1—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 Exposures				
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
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	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
300–1500 .....	.....	.....	f/1500	30
1500–100,000 .....	.....	.....	1.0	30

F= Frequency in MHz

Friis Formula

Friis transmission formula: $P_d = (P_{out} * G) / (4 * \pi * R^2)$

Where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d is the limit of MPE, 1 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.

5.1.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.



5.1.3 EUT RF Exposure Evaluation

1) exposure conditions for standalone operations

For BT

Antenna Gain: 3dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.995 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit	MPE Ratios	Result
Lowest	2402	10.55	11.35	0.0045	1.0	0.0045	PASS

Note: Refer to report No. SZEM170500450302 for EUT test Max Conducted Peak Output Power value. The distance r (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

For BLE

Antenna Gain: 3dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.995 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit	MPE Ratios	Result
Lowest	2402	2.66	1.85	0.0007	1.0	0.0007	PASS

Note: Refer to report No. SZEM170500450303 for EUT test Max Conducted Peak Output Power value. The distance r (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.



For WiFi 2.4G

Antenna No.	Antenna Gain (dBi)	Antenna Gain (linear scale)
1	3	1.995
2	3	1.995
MIMO		3.98

Output Power Into Antenna & RF Exposure Evaluation Distance:

SISO mode (Maximum E.I.R.P: 802.11g @ Ant. 2):

Channel	Frequency (MHz)	Max. Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit	MPE Ratios	Result
Lowest	2412	24.72	296.48	0.1177	1.0	0.1177	PASS

MIMO mode (Maximum E.I.R.P: 802.11n(HT40) with maximum antenna gain)

Channel	Frequency (MHz)	Max. Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit	MPE Ratios	Result
Highest	2452	28.06	639.73	0.5067	1.0	0.5067	PASS

Note: Refer to report No. SZEM170500450304 for EUT test Max Conducted Peak Output Power value.

The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.



For WiFi 5G:

Antenna No.	Antenna Gain (dBi)	Antenna Gain (linear scale)
1	3	1.995
2	3	1.995
MIMO		3.98

Output Power Into Antenna & RF Exposure Evaluation Distance:

SISO mode (Maximum E.I.R.P: 802.11a @ Ant. 1):

Channel	Frequency (MHz)	Max. Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit	MPE Ratios	Result
Middle	5300	13.9	24.55	0.0097	1.0	0.0097	PASS

MIMO mode (Maximum E.I.R.P: 802.11n(HT40) with maximum antenna gain)

Channel	Frequency (MHz)	Max. Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)	Limit	MPE Ratios	Result
Lowest	5270	17.72	59.16	0.0469	1.0	0.0469	PASS

Note: Refer to report No. SZEM170500450305 for EUT test Max Conducted Peak Output Power value. The distancer (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

2) exposure conditions for simultaneous transmission operations

Since the BT and BLE, 2.4G and 5G uses the same antennas, for MIMO mode, BT and BLE, 2.4G and 5G can't transmit simultaneously, the simultaneous transmission MPE is evaluated under SISO mode. Simultaneous transmission MPE test is not required, because the Max. sum of the MPE ratios for BT, WiFi 2.4G and WiFi 5G is $0.0045+0.5067+0.0469=0.5581 < 1$