

FCC RF EXPOSURE EVALUATION REPORT

Product Name: Smart Home Gateway
Trade Mark: Sunniwell
Model No.: S-GTAR100
Report Number: 181029005RFC-3
Test Standards: FCC 47 CFR Part 1 Subpart I
FCC ID: 2AJJP-GTAR100A
Test Result: PASS
Date of Issue: December 25, 2018

Prepared for:

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Version

Version No.	Date	Description
V1.0	December 25, 2018	Original

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1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Sunniwell Co., Ltd.
Address of Applicant:	1717 Haitai Building 229# Beisihuan Zhong Road, Bei jing 100083 P.R.China
Manufacturer:	Sunniwell Co., Ltd.
Address of Manufacturer:	1717 Haitai Building 229# Beisihuan Zhong Road, Bei jing 100083 P.R.China

1.2 EUT INFORMATION

Product Name:	Smart Home Gateway		
Model No.:	S-GTAR100		
Trade Mark:	Sunniwell		
DUT Stage:	Identical Prototype		
EUT Supports Function:	2.4 GHz ISM Band:	IEEE 802.11b/g/n	
	5 GHz U-NII Bands:	5 150 MHz to 5 250 MHz	IEEE 802.11a/n/ac
		5 725 MHz to 5 850 MHz	IEEE 802.11a/n/ac
Sample Received Date:	November 5, 2018		
Sample Tested Date:	November 5, 2018 to November 7, 2018		

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

For 2.4 GHz ISM Band of Wi-Fi			
Frequency Band:	2400 MHz to 2483.5 MHz		
Frequency Range:	2412 MHz to 2462 MHz		
Support Standards:	IEEE 802.11b, IEEE 802.11g, IEEE 802.11n-HT20, IEEE 802.11n-HT40		
Type of Modulation:	IEEE 802.11b: DSSS(CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM(64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11n-HT20: OFDM(64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11n-HT40: OFDM(64-QAM, 16-QAM, QPSK, BPSK)		
Data Rate:	IEEE 802.11b: Up to 11 Mbps IEEE 802.11g: Up to 54 Mbps IEEE 802.11n-HT20: Up to MCS7 IEEE 802.11n-HT40: Up to MCS7		
Number of Channels:	IEEE 802.11b: 11 IEEE 802.11g: 11 IEEE 802.11n-HT20: 11 IEEE 802.11n-HT40: 7		
Channel Separation:	5 MHz		
Antenna Type:	External Antenna		
Antenna Gain:	Chain 0	8 dBi	
	Chain 1	8 dBi	
Maximum Peak Power:	SISO_ Chain 0	IEEE 802.11b: 14.21 dBm IEEE 802.11g: 14.12 dBm IEEE 802.11n-HT20: 13.35 dBm IEEE 802.11n-HT40: 13.76 dBm	
	SISO_ Chain 1	IEEE 802.11b: 14.07 dBm IEEE 802.11g: 15.03 dBm IEEE 802.11n-HT20: 13.01 dBm IEEE 802.11n-HT40: 13.57 dBm	

For 5 GHz U-NII Bands of Wi-Fi			
Frequency Bands:	5150 MHz to 5250 MHz (U-NII-1)		
	5 725 MHz to 5 850 MHz (U-NII-3)		
Frequency Ranges:	5180 MHz to 5240 MHz		
	5 745 MHz to 5 825 MHz		
Support Standards:	IEEE 802.11/n/ac		
TPC Function:	Not Support		
	IEEE 802.11n: OFDM(64QAM, 16QAM, QPSK, BPSK)		
	IEEE 802.11ac: OFDM(256QAM, 64QAM, 16QAM, QPSK, BPSK)		
Channel Spacing:	IEEE 802.11n-HT20/ac-VHT20: 20 MHz		
	IEEE 802.11n-HT40: 40 MHz		
	IEEE 802.11n-HT20: Up to MCS15		
	IEEE 802.11n-HT40: Up to MCS15		
	IEEE 802.11ac-VHT20: Up to MCS8		
Number of Channels:	5150 MHz to 5250 MHz: 4 for IEEE 802.11n-HT20/ac-VHT20 2 for IEEE 802.11n-HT40		
	5725 MHz to 5850 MHz: 5 for IEEE 802.11n-HT20/ac-VHT20 2 for IEEE 802.11n-HT4/ac-VHT40		
Antenna Type:	Chain 0	External Antenna	
	Chain 1	External Antenna	
Antenna Gain:	Chain 0	5150 MHz to 5250 MHz: 8 dBi	
		5725 MHz to 5850 MHz: 8 dBi	
	Chain 1	5150 MHz to 5250 MHz: 8 dBi	
		5725 MHz to 5850 MHz: 8 dBi	
Maximum Conducted Output Power: dBm	MIMO_Chain 0+1		U-NII-1
	IEEE 802.11n-HT20:		15.11
	IEEE 802.11n-HT40:		14.59
	IEEE 802.11ac-VHT20:		14.78
			U-NII-3
			15.19
			15.06
			15.43

1.4 OTHER INFORMATION

Test channels for 2.4 GHz ISM Band of Wi-Fi				
Mode	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
IEEE 802.11b	2412 MHz to 2462 MHz	Channel 1	Channel 6	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11g	2412 MHz to 2462 MHz	Channel 1	Channel 6	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11n-HT20	2412 MHz to 2462 MHz	Channel 1	Channel 6	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11n-HT40	2422 MHz to 2452 MHz	Channel 3	Channel 6	Channel 9
		2422 MHz	2437 MHz	2452 MHz

Test channels for 5 GHz U-NII Bands of Wi-Fi				
Mode	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
IEEE 802.11n-HT20 IEEE 802.11ac-VHT20	5150 MHz to 5250 MHz	Channel 36	Channel 44	Channel 48
		5180 MHz	5220 MHz	5240 MHz
	5725 MHz to 5850 MHz	Channel 149	Channel 157	Channel 161
		5745 MHz	5785 MHz	5805 MHz
IEEE 802.11n-HT40	5150 MHz to 5250 MHz	Channel 38	--	Channel 46
		5190 MHz	--	5230 MHz
	5725 MHz to 5850 MHz	Channel 151	--	Channel 159
		5755 MHz	--	5795 MHz

1.5 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF product, according to the specifications of the manufacturers. It must comply with the requirements of the following standards:

FCC 47 CFR Part 1 Subpart I

All test items have been performed and recorded as per the above standards

1.6 TEST LOCATION

All tests were performed at:

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China 518109

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1.7 TEST FACILITY

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

CNAS-Lab Code: L9069

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC/EN 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

IC-Registration No.: 21600-1

The 3m Semi-anechoic chamber of Shenzhen UnionTrust Quality and Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 21600-1.

A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

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FCC Accredited Lab.

Designation Number: CN1194

Test Firm Registration Number: 259480

1.8 DEVIATION FROM STANDARDS

None.

1.9 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

2. EQUIPMENT LIST

Please refer to the RF test report.

3. MPE EVALUATION

3.1 REFERENCE DOCUMENTS FOR EVALUATION

No.	Identity	Document Title
1	FCC 47 CFR Part 1 Subpart I	PROCEDURES IMPLEMENTING THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969
2	KDB 447498 D01 General RF Exposure Guidance v06	RF EXPOSURE PROCEDURES AND EQUIPMENT AUTHORIZATION POLICIES FOR MOBILE AND PORTABLE DEVICES

3.2 MPE COMPLIANCE REQUIREMENT

3.2.1 Limits

According to §1.1307(b)(1), system operating under the provisions of this section shall be operating in a manner that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure.

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 Times 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
1500-100000	/	/	5	6

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 Times 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
1500-100000	/	/	1	30

Note: f = frequency in MHz: * = Plane-wave equivalents power density.

3.2.2 Test Procedure

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

3.3 MPE CALCULATION METHOD

$$S = PG/4\pi R^2 = EIRP/4\pi R^2$$

S = power density (in appropriate units, e.g., mW/cm²)

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 (in appropriate units, e.g., cm)

3.4 MPE CALCULATION RESULTS

Note: For the test results, the EUT had been tested with all conditions. But only the worst case was shown in

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test report.

3.4.1 For WLAN

For Wi-Fi function, operating at 2412MHz to 2462 MHz for IEEE802.11b/g/n and
operating at 5150 MHz to 5250 MHz for IEEE802.11n/ac and
operating at 5725 MHz to 5850 MHz for IEEE802.11n/ac.

3.4.1.1 Antenna Type:

Chain 0: External Antenna

Chain 1: External Antenna

3.4.1.2 Antenna Gain:

Chain 0: 2412MHz to 2462 MHz: 8 dBi

5150 MHz to 5250 MHz: 8 dBi

5725 MHz to 5850 MHz: 8 dBi

Chain 1: Same as chain 0

For MIMO mode (2Tx/2Rx), there are two transmission antennas. Both Chain 0 and Chain 1 used at the same time and antenna ports have uniform output powers. The Chain 0 and Chain 1 antenna ports can be used alone. The transmit signals are correlated with each other.

$$\text{The directional gain} = G_{\text{ANT}} + 10 \log(N_{\text{ANT}}) \text{ dBi} = 2 + 10 \log(2) = 11.01 \text{ dBi}$$

For SISO mode (1Tx/1Rx), there are two transmission antennas. Both Chain 0 and Chain 1 used at the same time and antenna ports have uniform output powers. The Chain 0 and Chain 1 antenna ports cannot be used alone

$$\text{The antenna gain} = \text{Chain 0 or Chain 1} = 8 \text{ dBi}$$

3.4.1.3 Results for WLAN

Operating Mode		Freq.	Declared maximum conducted average output power	Max. positive tolerance according manufacturer	Antenna Gain	Calculated maximum EIRP	Declared maximum EIRP	MPE Limit	MPE Value
		(MHz)	(dBm)		(dBi)	(dBm)	(mW)	(mw/cm ²)	
SISO	IEEE 802.11b IEEE 802.11g IEEE 802.11n-HT20	2412	14	2	8	24	251.1886	1	0.0500
		2437	14	2	8	24	251.1886	1	0.0500
		2462	14	2	8	24	251.1886	1	0.0500
	IEEE 802.11n-HT40	2422	13	2	8	23	199.5262	1	0.0397
		2437	13	2	8	23	199.5262	1	0.0397
		2452	13	2	8	23	199.5262	1	0.0397

Operating Mode		Freq.	Declared maximum conducted average output power	Max. positive tolerance according manufacturer	Antenna Gain	Calculated maximum EIRP	Declared maximum EIRP	MPE Limit	MPE Value
		(MHz)	(dBm)		(dBi)	(dBm)	(mW)	(mw/cm ²)	
MIMO	IEEE 802.11n-HT20 IEEE 802.11ac-VHT20	5180	15	2	11.01	28.01	632.4119	1	0.1258
		5220	15	2	11.01	28.01	632.4119	1	0.1258
		5240	15	2	11.01	28.01	632.4119	1	0.1258
		5745	15	2	11.01	28.01	632.4119	1	0.1258
		5785	15	2	11.01	28.01	632.4119	1	0.1258
		5805	15	2	11.01	28.01	632.4119	1	0.1258
	IEEE 802.11n-HT40 I	5190	15	2	11.01	28.01	632.4119	1	0.1258
		5230	15	2	11.01	28.01	632.4119	1	0.1258
		5755	15	2	11.01	28.01	632.4119	1	0.1258
		5795	15	2	11.01	28.01	632.4119	1	0.1258

APPENDIX 1 PHOTOS OF TEST SETUP

N/A

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

*** End of Report ***

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