RF EXPOSURE EVALUATION REPORT

Application No.:	GZCR2111021424AT
Applicant:	Outform Science & Technology (Shenzhen) Co., Ltd.
Address of Applicant:	Unit 3, 1st Floor, Huada Building, Gongye 3rd Road Yanshan Community, Zhaoshang Subdistrict Nanshan District, Shenzhen 518067 China
Manufacturer:	Outform Science & Technology (Shenzhen) Co., Ltd.
Address of Manufacturer:	Unit 3, 1st Floor, Huada Building, Gongye 3rd Road Yanshan Community, Zhaoshang Subdistrict Nanshan District, Shenzhen 518067 China
Factory:	Outform Science & Technology (Shenzhen) Co., Ltd.
Address of Factory:	Unit 3, 1st Floor, Huada Building, Gongye 3rd Road Yanshan Community, Zhaoshang Subdistrict Nanshan District, Shenzhen 518067 China
Equipment Under Test (EUT):	
EUT Name:	Micro Zappa Unit + Zappa Expansion Unit
Model No.:	UA200941-Z, UA220941-Z1, UA220941-Z2, UA220941-M1, UA200941-M2, UA220941-M3, UA220941-M4, UA220941-M8 ♣
♣	Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.
Standard(s) :	47 CFR Part 1.1307 47 CFR Part 1.1310 47 CFR Part 2.1091
Date of Receipt:	2021-09-26
Date of Evaluation:	2021-10-22 to 2022-06-20
Date of Issue:	2022-06-22
Evaluation Result:	**Pass***

* In the configuration evaluated, the EUT complied with the standards specified above.

Kobe Jian
EMC Laboratory Manager

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		*2022-06-22*		*Original*

Authorized for issue by				
		Curry Wu/Project Engineer		
		Ricky Liu/Reviewer		

2 Contents

Declaration of EUT Family Grouping:

Model No.: UA200941-Z, UA220941-Z1, UA220941-Z2, UA220941-M1, UA200941-M2, UA220941-M3, UA220941-M4, UA220941-M8, UA200941-M5, UA220941-M6, UA220941-M7

Only the model UA200941-Z was tested, since according to the declaration from the applicant, the electrical circuit design, PCB layout, components used and internal wiring and functions were identical for the above models, with only difference as below:

Model	Product Descriptions:	Micro Zappa Unit		Zappa Expansion Unit				400W PSU	US or ROW RELAY
		E4U4	OF2020Z	LC4	OF2020Z	H4P	Blank		
UA200941-Z	Retail Z-00 Full Zappa Hub Placement Demo	1	1	1	1	1	1	1	1
UA220941-Z1	Retail Z-01 Full Zappa Hub Placement (C3+Mod+All) Demo	1	1	1	1	1	1	1	1
UA220941-Z2	Retail Z-02 Full Zappa Hub Placement Demo, No Relay	1	1	1	1	1	1	1	NA
UA220941-M1	Retail M-01 Zappa Smart Home (MD+Plug and/or Bulb) Smaller Casing	Replaced by H4P	Replaced by Blank	NA	NA	NA	NA	1	1
UA200941-M2	Retail M-02 Zappa Energy, Smaller Casing	1	1	NA	NA	NA	NA	1	NA
UA220941-M3	Retail M-03 Zappa Security (C3+D2) Smaller Casing	1	Replaced by Blank	NA	NA	NA	NA	1	NA
UA220941-M4	Retail M-04 Zappa Smart Home (C3+Plug and/or Bulb) Smaller Casing	1	Replaced by Blank	NA	NA	NA	NA	1	1
UA220941-M8	Retail M-08 Zappa Relay Smart Home Smaller Casing	1	Replaced by H4P	NA	NA	NA	NA	1	1

UA200941-M5	M-05 Zappa Expansion Module	NA	NA	1	1	1	1	NA	1
UA220941-M6	M-06 Zappa Expansion Module	NA	NA	1	1	1	Replaced by OF2020Z	NA	1
UA220941-M7	M-07 Zappa Expansion Module	NA	NA	1	1	1	1	NA	NA

Considering all above model with same RF module and hardware design, it should not be affecting the test result then only UA200941-Z was tested. There have 2 power supplies for the RF module in the report including ADP-36C2 and 400W PSU, both supplies have been tested and only the worst one data was recorded in the report, ADP-36C2 is the worst one if no other remark in the test item.

3 General Information

3.1 Details of E.U.T.

Power supply:	DC 12V from AC/DC adapter which with 120Vac60Hz
For 2.4G:	
Operation Frequency:	802.11b/g/n(HT20): 2412MHz to 2462MHz, 802.11n(HT40): 2422MHz to 2452MHz
Modulation Type:	802.11b: DSSS (CCK, DQPSK, DBPSK), 802.11g/n: OFDM (64QAM, 16QAM, QPSK, BPSK)
Number of Channels:	802.11b/g/n(HT20): 13, 802.11n(HT40):9
Channel Spacing:	5MHz
Antenna Type:	Dipole Antenna
Antenna Gain:	2.5dBi declared by applicant
For 5G:	
Operation Frequency (20MHz):	U-NII-1: 5180-5240MHz; U-NII-2A: 5260-5320MHz; U-NII-2C: 5500-5700MHz; U-NII-3: 5745-5825MHz
Operation Frequency (40MHz):	U-NII-1: 5190-5230MHz (2 Channels); U-NII-2A: 5270-5310MHz (2 Channels); U-NII-2C: 5510-5670MHz (5 Channels); U-NII-3: 5755-5795MHz (2 Channels)
Operation Frequency (80MHz):	U-NII-1: 5210MHz (1 Channel); U-NII-2A: 5290MHz (1 Channel); U-NII-2C: 5530-5610MHz (2 Channels); U-NII-3: 5775MHz (1 Channel)
Modulation Type:	802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK); 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM); 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)
Channel Spacing:	802.11a/n(HT20)/ac(HT20): 20MHz; 802.11n(HT40)/ac(HT40): 40MHz; 802.11ac(HT80): 80MHz
DFS Function:	Slave without Radar detection
TPC Function:	Without TPC function
Antenna Type:	Dipole Antenna
Antenna Gain:	2 dBi declared by applicant

3.2 Evaluating Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou Branch EMC Laboratory,

198 Kezhu Road, Scientech Park, Guangzhou Economic & Technology Development District, Guangzhou, China 510663

Tel: +86 20 82155555 Fax: +86 20 82075059

No tests were sub-contracted.

3.3 Facility

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

- **NVLAP (Lab Code: 200611-0)**

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 200611-0.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

- **ACMA**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian/New Zealand Regulatory Compliance Mark (RCM).

- **SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO**

Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

- **CNAS (Lab Code: L0167)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been assessed and in compliance with CNAS-CL01:2018 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of Testing Laboratories.

- **FCC Recognized Accredited Test Firm(Registration No.: 486818)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation Number: CN5016, Test Firm Registration Number: 486818.

- **ISED (Registration No.: 4620B, CAB identifier: CN0052)**

SGS-CSTC Standards Technical Services Co., Ltd., has been registered by Innovation Science and Economic Development Canada for Wireless Device Testing laboratories to test to Canadian radio equipment requirements. Registration No. 4620B, CAB identifier: CN0052.

- **VCCI (Registration No.: R-12460, C-12584, G-20107 and T-11179)**

The 10m Semi-anechoic chamber, 966 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.: R-12460, C-12584, G-20107 and T-11179 respectively.

- **CBTL (Lab Code: TL129)**

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2017, the Basic Rules, IECEE 01 and Rules of procedure IECEE 02, and the relevant IECEE CB-Scheme Operational documents.

3.4 Deviation from Standards

None

3.5 Abnormalities from Standard Conditions

None

4 Radio Spectrum Technical Requirement

4.1 RF Exposure Compliance Requirement

4.1.1 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: Pd = (Pout*G)/(4* Pi * R 2)

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, 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.

4.1.2 Test Procedure

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

4.1.3 EUT RF Exposure Evaluation

For 2.4G Wi-Fi:

Antenna Gain: Antenna:2.5dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.78 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Frequency (MHz)	Mode	TX Type	Max Conducted Peak Output Power(dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit	Result
2437	802.11n (HT20)	SISO	17.05	50.70	0.0179	1.0	PASS

Note: Refer to report No. GZCR211102142401 for EUT test Max Conducted Output Power value.

The distance r (6th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

For 5G Wi-Fi:

Antenna Gain: Antenna : 2dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber are Antenna 1.59 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Frequency (MHz)	Mode	TX Type	Max Conducted Peak Output Power(dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit	Result
5670	802.11n (HT40)	SISO	10.03	10.07	0.0032	1.0	PASS

Exposure conditions for simultaneous transmission operations

Simultaneous transmission MPE test is not required, because the Max. sum of the MPE ratios for WiFi 2.4G and WiFi 5G is 0.0179/1.0+0.0032/1.0=0.0201 < 1

Note: Refer to report No. GZCR211102142402 for EUT test Max Conducted Peak Output Power value.

The distance r (6th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

5 EUT Constructional Details (EUT Photos)

Refer to appendix - external and internal photos for GZCR2111021424AT

- End of the Report -

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