1 Cover Page

RF Exposure Evaluation Report

Application No.:	KSCR2206000924AT
FCC ID:	2AL8S-0302C3XN-1
Applicant:	ZHEJIANG UNIVIEW TECHNOLOGIES CO., LTD
Address of Applicant:	88 JIANGLING ROAD, XIXING TOWN, BINJIANG DISTRICT, HANGZHOU CITY
Manufacturer:	ZHEJIANG UNIVIEW TECHNOLOGIES CO., LTD
Address of Manufacturer:	88 JIANGLING ROAD, XIXING TOWN, BINJIANG DISTRICT, HANGZHOU CITY
Factory:	Zhejiang Uniview System Technology Co., Ltd.
Address of Factory:	No.1277 Qingfeng South Road (South), Tongxiang Economic Development Zone, 314500 TongxiangCity, Jiaxing City, PEOPLE'S REPUBLIC OF CHINA
Equipment Under Test (EUT):	
EUT Name:	WiFi + BT Module
Model No.:	WF-M63B-USH1
Standard(s) :	FCC Rules 47 CFR §2.1091 KDB 447498 D04 interim General RF Exposure Guidance v01
Date of Receipt:	2022-06-06
Date of Test:	2022-07-08 to 2022-07-11
Date of Issue:	2022-07-12
Test Result:	**Pass***

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

Eric Lin
Laboratory Manager

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Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		2022-07-12		Original

Authorized for issue by:				
		Eric_Liu /Project Engineer		
		Eric Lin/Reviewer		

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2 Contents

3 General Information

3.1 General Description of E.U.T.

Power supply:	DC 3.3V

3.2 Details of E.U.T.

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):11;802.11n(HT40):7
Channel Spacing:	5MHz
Antenna Type:	Antenna 1: PCB Antenna Antenna 2: PCB Antenna
Antenna Gain:	Ant 1: 0.06dBi (Provided by the manufacturer) Ant 2: 2.65dBi (Provided by the manufacturer) Directional gain:4.61dBi

BT

Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V2.1+EDR
Modulation Type:	GFSK, pi/4DQPSK, 8DPSK
Data Rate:	1Mbps; 2Mbps; 3Mbps
Number of Channels:	79
Channel Spacing:	1MHz
Spectrum Spread Technology:	Frequency Hopping Spread Spectrum(FHSS)
Antenna Type:	PCB Antenna
Antenna Gain:	0.37dBi (Provided by the manufacturer)

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BLE

Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V5.1
Modulation Type:	GFSK
Data Rate:	1Mbps; 2Mbps
Number of Channels:	40
Channel Spacing:	2MHz
Antenna Type:	PCB Antenna
Antenna Gain:	0.37dBi (Provided by the manufacturer)

5G

Operation Frequency (20MHz):	U-NII-1: 5180-5240MHz; U-NII-3: 5745-5825MHz
Operation Frequency (40MHz):	U-NII-1: 5190-5230MHz; U-NII-3: 5755-5795MHz
Operation Frequency (80MHz):	U-NII-1: 5210MHz; U-NII-3: 5775MHz
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(VHT20): 20MHz; 802.11n(HT40)/ac(VHT40): 40MHz; 802.11ac(VHT80): 80MHz
Antenna Type:	Ant 1: PCB Antenna Ant 2: PCB Antenna
Antenna Gain:	Ant 1: U-NII-1: 0.29dBi (Provided by manufacturer) U-NII-3: -1.16dBi (Provided by manufacturer) Ant 2: U-NII-1: 0.12dBi (Provided by manufacturer) U-NII-3: 0.99dBi (Provided by manufacturer)

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3.3 Test Location

All tests were performed at:

Compliance Certification Services (Kunshan) Inc.

No.10 Weiye Rd, Innovation park, Eco&Tec, Development Zone, Kunshan City, Jiangsu, China.

Tel: +86 512 5735 5888 Fax: +86 512 5737 0818

No tests were sub-contracted.

Note:

1.SGS is not responsible for wrong test results due to incorrect information (e.g. max. clock frequency, highest internal frequency, antenna gain, cable loss, etc) is provided by the applicant. (if applicable).

2.SGS is not responsible for the authenticity, integrity and the validity of the conclusion based on results of the data provided by applicant. (if applicable).

3.4 Test Facility

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

• CNAS (No. CNAS L4354)

CNAS has accredited Compliance Certification Services (Kunshan) Inc. to ISO/IEC 17025:2017 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. 2541.01)

Compliance Certification Services (Kunshan) Inc. is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 2541.01.

• FCC (Designation Number: CN1172)

Compliance Certification Services (Kunshan) Inc. has been recognized as an accredited testing laboratory.

Designation Number: CN1172.

• ISED (CAB identifier: CN0072)

Compliance Certification Services (Kunshan) Inc. has been recognized by Innovation, Science and Economic Development Canada (ISED) as an accredited testing laboratory.

Company Number: 2324E

• VCCI (Member No.: 1938)

The 3m and 10m Semi-anechoic chamber and Shielded Room of Compliance Certification Services (Kunshan) Inc. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-20134, R-11600, C-11707, T-11499, G-10216 respectively.

4 FCC Radiofrequency radiation exposure limits

Test exemptions apply for devices used in general population/uncontrolled exposure environments, according to the SAR-based, or MPE-based exemption thresholds.

4.1 Blanket 1 mW Blanket Exemption

The 1 mW Blanket Exemption of §1.1307(b)(3)(i)(A) applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power of no more than 1 mW, regardless of separation distance.

The 1-mW blanket exemption applies at separation distances less than 0.5 cm, including where there is no separation. This exemption shall not be used in conjunction with other exemption criteria other than those for multiple RF sources in paragraph §1.1307(b)(3)(ii)(A).

The 1-mW exemption is independent of service type and covers the full range of 100 kHz to 100 GHz, but it shall not be used in conjunction with other exemption criteria or in devices with higher-power transmitters operating in the same time-averaging period. Exposure from such higher-power transmitters would invalidate the underlying assumption that exposure from the lower-power transmitter is the only contributor to SAR in the relevant volume of tissue.

4.2 MPE-based Exemption

General frequency and separation-distance dependent MPE-based effective radiated power (ERP) thresholds are in Table B.1 [Table 1 of §1.1307(b)(1)(i)(C)] to support an exemption from further evaluation from 300 kHz through 100 GHz.

Table B.1—Thresholds For Single RF Sources Subject to Routine Environmental Evaluation

RF Source Frequency			Minimum Distance			Threshold ERP
f_L MHz		f_H MHz	$\lambda_L / 2\pi$		$\lambda_H / 2\pi$	W
0.3	–	1.34	159 m	–	35.6 m	1,920 R^2
1.34	–	30	35.6 m	–	1.6 m	3,450 R^2/f^2
30	–	300	1.6 m	–	159 mm	3.83 R^2
300	–	1,500	159 mm	–	31.8 mm	0.0128 R^2f
1,500	–	100,000	31.8 mm	–	0.5 mm	19.2R^2
Subscripts L and H are low and high; λ is wavelength. From §1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns.						

The table applies to any RF source (i.e. single fixed, mobile, and portable transmitters) and specifies power and distance criteria for each of the five frequency ranges used for the MPE limits. These criteria apply at separation distances from any part of the radiating structure of at least λ/2π. The thresholds are

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based on the general population MPE limits with a single perfect reflection, outside of the reactive near-field, and in the main beam of the radiator.

For mobile devices that are not exempt per Table B.1 [Table 1 of §1.1307(b)(1)(i)(C)] at distances from 20 cm to 40 cm and in 0.3 GHz to 6 GHz, evaluation of compliance with the exposure limits in §1.1310 is necessary if the ERP of the device is greater than ERP_{20cm} in Formula (B.1) [repeated from §2.1091(c)(1); also in §1.1307(b)(1)(i)(B)].

$$P_{\text{th}}\ (\text{mW}) = ERP_{20\ \text{cm}}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases} \qquad (\text{B.1})$$

If the ERP is not easily obtained, then the available maximum time-averaged power may be used (i.e., without consideration of ERP only if the physical dimensions of the radiating structure(s) do not exceed the electrical length of λ/4 or if the antenna gain is less than that of a half-wave dipole.

SAR-based exemptions are constant at separation distances between 20 cm and 40 cm to avoid discontinuities in the threshold when transitioning between SAR-based and MPE-based exemption criteria at 40 cm, considering the importance of reflections.

Limit calculation			
Frequency range	Frequency(MHz)	R(λ/2π)(m)	Threshold ERP(W)
300~1500MHz	**915**	0.0522	0.032
1500~100000MHz	**2462**	0.0194	0.007

4.3 SAR-based Exemption

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time-averaged power or maximum time-averaged ERP, whichever is greater.

If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the applicant may use the available maximum time-averaged power exclusively if the device antenna or radiating structure does not exceed an electrical length of λ/4.

As for devices with antennas of length greater than λ/4 where the gain is not well defined, but always less than that of a half-wave dipole (length λ/2), the available maximum time-averaged power generated by the device may be used in place of the maximum time-averaged ERP, where that value is not known.

The separation distance is the smallest distance from any part of the antenna or radiating structure for all persons, during operation at the applicable ERP. In the case of mobile or portable devices, the separation distance is from the outer housing of the device where it is closest to the antenna.

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The SAR-based exemption formula of §1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by Formula (B.2).

$$P_{th}\,(\mathrm{mW}) = \begin{cases} ERP_{20\,\mathrm{cm}}(d/20\,\mathrm{cm})^{x} & d \le 20\,\mathrm{cm} \\ ERP_{20\,\mathrm{cm}} & 20\,\mathrm{cm} < d \le 40\,\mathrm{cm} \end{cases} \qquad (B.2)$$

where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\,\mathrm{cm}}\sqrt{f}}\right)$$

and f is in GHz, d is the separation distance (cm), and ERP_{20cm} is per Formula (B.1).

Example values shown in Table B.2 are for illustration only.

Table B.2—Example Power Thresholds (mW)

Frequency (MHz)	Distance(mm)									
	5	10	15	20	25	30	35	40	45	50
300	39	65	88	110	129	148	166	184	201	217
450	22	44	67	89	112	135	158	180	203	226
835	9	25	44	66	90	116	145	175	207	240
1900	3	12	26	44	66	92	122	157	195	236
2450	3	10	22	38	59	83	111	143	179	219
3600	2	8	18	32	49	71	96	125	158	195
5800	1	6	14	25	40	58	80	106	136	169

Limit calculation				
Frequency range(GHz)	Frequency(GHz)	X	Distance(cm)	Pth (mW)
1.5~6	**2.462**	1.903	**20**	**3060.000**

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5 Measurement and Calculation

5.1 Maximum transmit power

The Power Data is based on the RF Test Report KSCR220600092401.

Test Mode	Channel	Antenna 1 Power[dBm]	Antenna 2 Power[dBm]	MIMO Power[dBm]	Antenna 1 Power[mW]	Antenna 2 Power[mW]	MIMO Power[mW]
11B	2412	16.01	15.87	NA	**39.90**	38.64	N/A
11B	2437	15.73	16.00	NA	37.41	**39.81**	N/A
11B	2462	15.97	15.90	NA	39.54	38.90	N/A
11G	2412	13.60	14.40	NA	22.91	27.54	N/A
11G	2437	13.81	14.49	NA	24.04	28.12	N/A
11G	2462	14.21	14.36	NA	26.36	27.29	N/A
11N20MIMO	2412	10.76	11.81	14.33	11.91	15.17	27.10
11N20MIMO	2437	11.04	11.64	14.36	12.71	14.59	27.29
11N20MIMO	2462	11.32	11.64	14.49	13.55	14.59	**28.12**
11N40MIMO	2422	9.92	10.73	13.35	9.82	11.83	21.63
11N40MIMO	2437	10.18	10.59	13.40	10.42	11.46	21.88
11N40MIMO	2452	10.38	10.68	13.54	10.91	11.69	22.59

The Power Data is based on the RF Test Report KSCR220600092402

Test Mode	Test Frequency (MHz)	Output Power (dBm)	Reading Power (mW)
GFSK	2402	12.46	17.62
	2441	12.54	17.95
	2480	12.37	17.26
π/4DQPSK	2402	12.36	17.22
	2441	12.46	17.62
	2480	12.38	17.30
8DPSK	2402	12.67	**18.49**
	2441	12.55	17.99
	2480	12.44	17.54

The Power Data is based on the RF Test Report KSCR220600092403

Test Mode	Test Frequency (MHz)	Output Power (dBm)	Output Power (mW)
1M	2402	12.71	18.66
	2442	12.63	18.32
	2480	12.51	17.82
2M	2402	12.76	**18.88**
	2442	12.69	18.58
	2480	12.59	18.16

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The Power Data is based on the RF Test Report KSCR220600092404

Test Mode	Channel	Antenna 1 Power[dBm]	Antenna 2 Power[dBm]	MIMO Power[dBm]	Antenna 1 Power[mW]	Antenna 2 Power[mW]	MIMO Power [mW]
802.11a	5180	10.21	10.45	NA	10.50	11.09	NA
802.11a	5200	10.20	10.37	NA	10.47	10.89	NA
802.11a	5240	10.34	10.62	NA	10.81	11.53	NA
802.11a	5745	10.62	10.34	NA	11.53	10.81	NA
802.11a	5785	11.32	11.13	NA	**13.55**	12.97	NA
802.11a	5825	11.19	11.46	NA	13.15	**14.00**	NA
802.11n (HT20)	5180	8.52	6.74	10.73	7.11	4.72	11.83
802.11n (HT20)	5200	8.36	6.69	10.62	6.85	4.67	11.53
802.11n (HT20)	5240	8.69	7.01	10.94	7.40	5.02	12.42
802.11n (HT20)	5745	7.94	7.61	10.79	6.22	5.77	11.99
802.11n (HT20)	5785	8.40	8.52	11.47	6.92	7.11	14.03
802.11n (HT20)	5825	8.27	8.89	11.60	6.71	7.74	14.45
802.11n (HT40)	5190	8.55	6.77	10.76	7.16	4.75	11.91
802.11n (HT40)	5230	8.72	6.99	10.95	7.45	5.00	12.45
802.11n (HT40)	5755	7.99	7.82	10.92	6.30	6.05	12.36
802.11n (HT40)	5795	8.30	8.42	11.37	6.76	6.95	13.71
802.11ac (VHT20)	5180	8.65	6.88	10.86	7.33	4.88	12.19
802.11ac (VHT20)	5200	8.31	6.73	10.60	6.78	4.71	11.48

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Test Mode	Channel	Antenna 1 Power[dBm]	Antenna 2 Power[dBm]	MIMO Power[dBm]	Antenna 1 Power[mW]	Antenna 2 Power[mW]	MIMO Power [mW]
802.11ac (VHT20)	5240	8.46	6.87	10.75	7.01	4.86	11.89
802.11ac (VHT20)	5745	7.72	7.48	10.61	5.92	5.60	11.51
802.11ac (VHT20)	5785	8.16	8.34	11.26	6.55	6.82	13.37
802.11ac (VHT20)	5825	8.16	8.76	11.48	6.55	7.52	14.06
802.11ac (VHT40)	5190	8.80	7.04	11.02	7.59	5.06	12.65
802.11ac (VHT40)	5230	8.95	7.22	11.18	7.85	5.27	13.12
802.11ac (VHT40)	5755	8.27	8.12	11.21	6.71	6.49	13.21
802.11ac (VHT40)	5795	8.56	8.72	11.65	7.18	7.45	**14.62**
802.11ac (VHT80)	5210	8.33	6.60	10.56	6.81	4.57	11.38
802.11ac (VHT80)	5775	8.45	8.34	11.41	7.00	6.82	13.84

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5.2 RF Exposure Calculation

For FCC

2.4G:

The Max Conducted Peak Output Power is 39.90 mW for antenna1,. 39.81 mW for antenna2,. The best case gain of the antenna is 0.06dBi for antenna1 and 2.65dBi for antenna2.

0.06dBi logarithmic terms convert to numeric result is nearly 1.01.

2.65dBi logarithmic terms convert to numeric result is nearly 1.84.

4.61dBi logarithmic terms convert to numeric result is nearly 2.89.

According to the formula. calculate the EIRP test result:

Antenna1: EIRP= P x G = 39.90 mW x 1.01 = 40.30mW

Antenna2: EIRP= P x G = 39.81 mW x 1.84 = 73.25mW

In MIMO mode: EIRP= P x G = 28.12 mW x 2.89= 81.27mW

BT:

The Max Conducted Peak Output Power is 18.88mW,. The best case gain of the antenna is 0.37dBi.

0.37dBi logarithmic terms convert to numeric result is nearly 1.09.

According to the formula. calculate the EIRP test result:

EIRP= P x G = 18.88 mW x 1.09 = 20.58mW

5G:

The Max Conducted Peak Output Power is 13.55 mW for antenna1,. 14.00 mW for antenna2,. The best case gain of the antenna is 0.29dBi for antenna1 and 0.12dBi for antenna2.

0.29dBi logarithmic terms convert to numeric result is nearly 1.07.

0.12dBi logarithmic terms convert to numeric result is nearly 1.03.

3.22dBi logarithmic terms convert to numeric result is nearly 2.10.

According to the formula. calculate the EIRP test result:

Antenna1: EIRP= P x G = 13.55 mW x 1.07 = 14.50mW

Antenna2: EIRP= P x G = 14.00 mW x 1.03 = 14.42mW

In MIMO mode: EIRP= P x G = 14.62 mW x 2.10 = 30.70mW

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The 2.4GHz WiFi,BTand 5GHz WiFi can transmit simultaneously, but the maximum rate of MPE is 81.27/3060+20.58/3060+30.70/3060=0.0266+0.0067+0.0100=0.0433≤1.

Remark: we used the maximum power between the conducted power and ERP/EIRP to perform RF exposure exemption evaluation.

	Evaluation method	Exempt Limit(mW)	Verdict
☐	Blanket 1 mW Blanket Exemption	1mW	N/A
☐	MPE-based Exemption(ERP)	7mW(ERP) (2.4GHz Band)	N/A
☒	SAR-based Exemption(P_{th})	3060mW(ERP) (1.5GHz~6GHz)	Yes

So, the device is to qualify for SAR test exemption, the exemption report is in lieu of the SAR report

--End of the Report--