1 Cover Page

RF Exposure Evaluation Report

Application No.:	KSCR2209001658AT
FCC ID:	2AXLB-EAVSUT30
Applicant:	SUZHOU EAVISION ROBOTIC TECHNOLOGIES CO., LTD
Address of Applicant:	Unit 1-A, No.3 Workshop, 28 Xiasheng Road, SIP, Suzhou, China
Manufacturer:	SUZHOU EAVISION ROBOTIC TECHNOLOGIES CO., LTD
Address of Manufacturer:	Unit 1-A, No.3 Workshop, 28 Xiasheng Road, SIP, Suzhou, China
Factory:	SUZHOU EAVISION ROBOTIC TECHNOLOGIES CO., LTD
Address of Factory:	Unit 1-A, No.3 Workshop, 28 Xiasheng Road, SIP, Suzhou, China
Equipment Under Test (EUT):	
EUT Name:	EAVision Unicom Map Surveyor
Model No.:	EAV-SUT30
Standard(s) :	FCC Rules 47 CFR §2.1091 KDB 447498 D04 interim General RF Exposure Guidance v01
Date of Receipt:	2022-09-07
Date of Test:	2022-09-08 to 2022-10-01
Date of Issue:	2022-10-11
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	**Description**	**Date**	**Remark**
00	Original	2022-10-11	/

Authorized for issue by:				
		Tommie Tang		
		Tommie_Tang/Project Engineer		
		Eric Lin		
		Eric Lin /Reviewer		

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3 General Information

3.1 General Description of E.U.T.

Power supply:	DC 9V,2A

3.2 Details of E.U.T.

BT

Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V4.2 Dual mode
Modulation Type:	GFSK, pi/4DQPSK, 8DPSK
Number of Channels:	79
Channel Spacing:	1MHz
Spectrum Spread Technology:	Frequency Hopping Spread Spectrum(FHSS)
Antenna Type:	FPC Antenna
Antenna Gain:	2.22dBi (Provided by manufacturer)

BLE

Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V4.2 Dual mode
Modulation Type:	GFSK
Data Rate:	1Mbps
Number of Channels:	40
Channel Spacing:	2MHz
Antenna Type:	FPC Antenna
Antenna Gain:	2.22dBi (Provided by manufacturer)

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2.4G (p2400) (the module has been certified，FCC ID: NS9P2400)

Operation Frequency:	2401.6MHz to 2411.2MHz, 2434.8MHz to 2444.8MHz, 2468.0MHz to 2477.6MHz
Modulation Type:	GFSK
Number of Channels:	76
Channel Spacing:	400KHz
Antenna Type:	Dipole Antenna
Antenna Gain:	2dBi (Provided by manufacturer)

3.3 Test Location

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**

Compliance Certification Services (Kunshan) Inc. is accredited by the China National Accreditation Service for Conformity Assessment (CNAS). Registration No. CNAS L4354

- **A2LA**

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

- **FCC**

Compliance Certification Services (Kunshan) Inc. has been recognized as an accredited testing laboratory. Designation Number: CN1172.

- **ISED**

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**

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.

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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)].

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

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).

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

where

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

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

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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

2.4G (p2400)

Limit calculation				
Frequency range(GHz)	Frequency(GHz)	X	Distance(cm)	Pth (mW)
1.5~6	**2.4776**	1.905	**20**	**3060.000**

BT/BLE

Limit calculation				
Frequency range(GHz)	Frequency(GHz)	X	Distance(cm)	Pth (mW)
1.5~6	**2.48**	1.905	**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 KSCR220900165801 & KSCR220900165802

BT

Test Mode	Test Frequency (MHz)	Maximum Peak Output Power(dBm)	Output Power (mW)
GFSK	2402	7.70	5.89
	2441	8.43	6.97
	2480	7.85	6.10
π/4DQPSK	2402	8.47	7.03
	2441	8.88	7.73
	2480	7.97	6.27
8DPSK	2402	8.64	7.31
	2441	9.10	**8.13**
	2480	8.25	6.68

BLE

Test Mode	Test Frequency (MHz)	Output Power (dBm)	Output Power (mW)
1M	2402	5.26	3.36
	2442	6.09	**4.06**
	2480	5.66	3.68

2.4G (p2400)

The power of 2.4G base on the FCC certificate module of p2400,

FCC ID is:NS9P2400, the maximum output power refer to test report: 16MCRS096_FCC15C247

The Max Conducted Output Power is 29.95dBm (988.6mW).

5.2 RF Exposure Calculation

BT

The Max Conducted Output Power is 8.13mW. The best case gain of the antenna is 2.22dBi.

2.22dBi logarithmic terms convert to numeric result is nearly 1.67.

According to the formula. calculate the EIRP test result:

EIRP= P x G = 8.13mW x 1.67 = 13.58mW < 3060mW

BLE

The Max Conducted Output Power is 4.06mW. The best case gain of the antenna is 2.22dBi.

2.22dBi logarithmic terms convert to numeric result is nearly 1.67.

According to the formula. calculate the EIRP test result:

EIRP= P x G = 4.06mW x 1.67 = 6.78mW < 3060mW

2.4G (p2400)

The Max Conducted Output Power is 988.6mW. The best case gain of the antenna is 2dBi.

2dBi logarithmic terms convert to numeric result is nearly 1.58.

According to the formula. calculate the EIRP test result:

EIRP= P x G = 988.6mW x 1.58 = 1561.99mW < 3060mW

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

BT/BLE and 2.4G can transmit simultaneously, and 13.58/3060+1561.99/3060=0.51<1, so the device is to qualify for SAR test exemption.

--End of the Report--

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