



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

SZEMC-TRF-01 Rev. A/0 Aug01,2022

Report No.: SZCR230800254210

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RF EXPOSURE EVALUATION REPORT

Application No.: SZCR2308002542AT
Applicant: Grab Technology LLC
Address of Applicant: 113 Cherry ST PMB 78120 Seattle, WA 98104 USA
Manufacturer: Grabtaxi Holdings Pte. Ltd.
Address of Manufacturer: 3 Media Cl, Singapore 138498
Factory: SKY LIGHT Electronic (ShenZhen) Limited
Address of Factory: No. 8 & 9 Building, AnTuoShan High-tech Industrial Area, Xinsha Road, ShaJing, Bao'An, Shenzhen, China.

Equipment Under Test (EUT):
EUT Name: KartaCam 2
Model No.: GKS200
FCC ID: 2BB5A-GKS200
Standard(s) : FCC Rules 47 CFR §2.1091
KDB 447498 D04 interim General RF Exposure Guidance v01

Date of Receipt: 2023-08-07
Date of Evaluation: 2023-08-11 to 2023-09-28
Date of Issue: 2023-09-28

Evaluation Result:	Pass*
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* In the configuration evaluated, the EUT complied with the standards specified above.

Kenx. Xu

Kenx Xu

EMC Laboratory Manager



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

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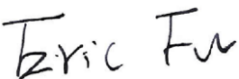
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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2023-09-28		Original

Authorized for issue by:				
				
		Leo Lai/Project Engineer		
				
		Eric Fu/Reviewer		



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3 General Information

3.1 General Description of E.U.T.

Product Type:	☐ Portable device
	☒ Mobile device
	☐ Fixed device

3.2 Details of E.U.T.

Power supply:	DC 3.7V from internal battery and which can be charged by DC 12V or Type USB port with 5V/3A,9V/3A,12V/3A,15V/3A
For BT	
Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V5.0
Modulation Type:	GFSK, Pi/4DQPSK, 8DPSK
Channel Spacing:	1MHz
Number of Channels:	79
Antenna Type:	PIFA Antenna
Antenna Gain:	2.41dBi
For BLE:	
Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V5.0
Modulation Type:	GFSK
Channel Spacing:	2MHz
Number of Channels:	40
Antenna Type:	PIFA Antenna
Antenna Gain:	2.41dBi
For 2.4G WIFI:	
Operation Frequency:	802.11b/g/n(HT20)/ax(HEW20): 2412MHz to 2462MHz
Modulation Type:	802.11b: DSSS (CCK, DQPSK, DBPSK), 802.11g/n: OFDM (64QAM, 16QAM, QPSK, BPSK)
Channel Spacing:	5MHz
Number of Channels:	802.11b/g/n(HT20)/ax(HEW20): 11
Antenna Type:	PIFA Antenna
Antenna Gain:	ANT1: 2.41dBi, ANT2: 2.41dBi

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For 5G WIFI:

Operation Frequency:	Band	Mode	Frequency Range(MHz)	Number of channels
	UNII Band I	802.11a/n(HT20)/ac(VHT20)/ax(HE W20)	5180-5240	4
		802.11n(HT40)/ac(VHT40)/ax(HEW40)	5190-5230	2
		802.11ac(VHT80)/ax(HEW80)	5210	1
	UNII Band II-A	802.11a/n(HT20)/ac(VHT20)/ax(HE W20)	5260-5320	4
		802.11n(HT40)/ac(VHT40)/ax(HEW40)	5270-5310	2
		802.11ac(VHT80)/ax(HEW80)	5290	1
	UNII Band II-C	802.11a/n(HT20)/ac(VHT20)/ax(HE W20)	5500-5700	11
		802.11n(HT40)/ac(VHT40)/ax(HEW40)	5510-5670	5
		802.11ac(VHT80)/ax(HEW80)	5530-5630	2
	UNII Band III	802.11a/n(HT20)/ac(VHT20)/ax(HE W20)	5745-5825	5
		802.11n(HT40)/ac(VHT40)/ax(HEW40)	5755-5895	2
		802.11ac(VHT80)/ax(HEW80)	5775	1
Modulation Type:	802.11a: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) 802.11ax: OFDM&OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)			
Channel Spacing:	802.11a/n(HT20)/ac(VHT20)/ax(HEW20) : 20MHz 802.11n(HT40)/ac(VHT40)/ax(HEW40) : 40MHz 802.11ac(VHT80)/ax(HEW80) : 80MHz			

Remark:The information in this section is provided by the applicant or manufacturer, SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.

Lora:	
Operation Frequency:	903MHz to 927MHz
Modulation Type:	FSK
Channel Spacing:	1MHz
Number of Channels:	25
Antenna Type:	PIFA Antenna
Antenna Gain:	0.08dBi

GSM

Support Network:	GPRS, EGPRS
Operation Frequency	GSM850/PCS1900



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Band:	
Modulation Type:	GMSK for GPRS/EGPRS; 8PSK for EGPRS;
GPRS Class:	12
EGPRS Class:	12
Antenna Type:	PIFA Antenna
Antenna Gain:	GSM850: 2.13dBi PCS1900: 2.76dBi

WCDMA

Support Network:	RMC, HSDPA, HSUPA
Operation Frequency Band:	UMTS FDD Band II/IV/V
Modulation Type:	QPSK for WCDMA
Supported Channel Bandwidth:	5MHz for WCDMA
UMTS Power Class:	Level 3
Antenna Type:	PIFA Antenna
Antenna Gain:	Band 2: 2.76, Band 4: 5dBi, Band 5: 2.13dBi

LTE

LTE Operation Frequency Band:	LTE FDD Band 2,4,5,7,12,13,25,26,38,41
Modulation Type:	QPSK, 16QAM
LTE Power Class:	Level 3
Antenna Type:	PIFA Antenna
Antenna Gain:	B2: 2.76dBi, B4: 5dBi, B5: 2.13dBi, B7: 2.59dBi, B12: 3.78dBi, B13: 2.61dBi, B25: 2.76dBi, B26: 2.13dBi, B38: 3.68dBi, B41: 5.98dBi

3.3 Separation Distance

Minimum test separation distance:	20cm
Remark: This minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander.	

3.4 Test Location

All tests were performed at:

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No tests were sub-contracted.

3.5 Test Facility

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

• 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 (Member No. 1937)

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen EMC laboratory have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• FCC –Designation Number: CN1336

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

Designation Number: CN1336. Test Firm Registration Number: 787754.

• Innovation, Science and Economic Development Canada

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

CAB identifier: CN0006.

IC#: 4620C.

3.6 Deviation from Standards

None

3.7 Abnormalities from Standard Conditions

None



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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 ² f
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 $\lambda/2\pi$. The thresholds are

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)].

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

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 $\lambda/4$ 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)	$R(\lambda/2\pi)(m)$	Threshold ERP(W)
300~1500MHz	915	0.0522	0.032
1500~100000MHz	2480	0.0193	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 $\lambda/4$.

As for devices with antennas of length greater than $\lambda/4$ where the gain is not well defined, but always less than that of a half-wave dipole (length $\lambda/2$), 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.



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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.

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).

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

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 $ERP_{20 \text{ cm}}$ 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)
0.3~1.5	0.915	1.474	0.5	8.133
1.5~6	2.48	1.905	0.5	2.717

5 Measurement and Calculation

5.1 Maximum transmit power

Output Power Into Antenna & RF Exposure Evaluation Distance:

Test Mode:	Antenna Gain (dBi)	Frequency (MHz)	Maximum Conducted Power [dBm]	Maximum Conducted EIRP [dBm]	Maximum Conducted EIRP (mW)
BT	2.41	2480	9	11.41	13.836
BLE	2.41	2480	7	9.41	8.730
2.4G WIFI	ANT1: 2.41, ANT2: 2.41	2437	19	24.42	276.694
5 WIFI	ANT1:6.02, ANT2: 6.02	5240	15.5	24.53	283.792
Lora	0.08	916	10.5	10.58	11.429

Operating Band	Frequency (MHz)	Antenna Gain (dBi)	Max Conducted Average Output Power (dBm)	Output Power to Antenna (dBm)	EIRP(ERP) Limit (dBm)	Output Power to Antenna (mW)
GSM850	836.6	2.13	34	36.13	33.98	2500.345
GSM1900	1850.2	2.76	27	29.76	29.76	946.237
WCDMA B2	1907.6	2.13	21	23.13	23.13	205.589
WCDMA B4	1732.6	5	22	27	27	501.187
WCDMA B5	826.4	2.76	23	25.76	23.61	229.615
LTE B2	1860	2.13	21	23.13	23.13	205.589
LTE B4	1732.5	5	22	27	27	501.187
LTE B5	824.7	2.76	23.5	26.26	24.11	257.632
LTE B7	2510	2.59	24.5	27.09	27.09	511.682
LTE B12	707.5	3.78	23	26.78	24.63	290.402
LTE B13	782	2.61	24.5	27.11	24.96	313.329
LTE B25	1882.5	2.76	21	23.76	23.76	237.684
LTE B26	814.7	2.13	23	25.13	22.98	198.609
LTE B38	2580	3.68	23	26.68	26.68	465.586
LTE B41	2501	5.98	22	27.98	27.98	628.058

Note: Refer to the Tune up procedure for EUT test Max Power Value.

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



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5.2 RF Exposure Calculation

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

Standalone:

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

Simultaneously:

The Max Power/EIRP is GSM 850+5G WiFi +BT+Lora= 2500.345+283.792+13.836+11.429mW
=2809.402mW < 3060mW

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

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

6 EUT Constructional Details (EUT Photos)

Refer to Appendix - Photographs of EUT Constructional Details for SZCR2308002542AT.

--End of the Report--



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