

1 Cover Page

RF Exposure Evaluation Report

Application No.: SHCR2210002323AT
FCC ID: 2A3IQ-2032G40
Applicant: Hangzhou HikAuto Technology Co., Ltd.
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Manufacturer: Hangzhou HikAuto Technology Co., Ltd.
Address of Manufacturer: Room 309, Floor B, Building 2, No. 399, Danfeng Road, Binjiang District, Hangzhou City, Zhejiang, 310052, China
Factory: Hangzhou HikAuto Technology Co., Ltd.
Address of Factory: 1, Room 309, Floor B, Building 2, No. 399, Danfeng Road, Binjiang District, Hangzhou City, Zhejiang, 310052, China
 2, No.188, Dongjia Road, Tonglu County, Hangzhou City, Zhejiang, 311500, China
 3, No.700, Dongliu Road, Binjiang District, Hangzhou City, Zhejiang, 310052, China
Equipment Under Test (EUT):
EUT Name: DashCam
Model No.: AE-DI2032-G40
Add Model No.: AE-DI2032-G40 Lite, AE-DI2032-G40 Pro, AE-DI2032-G40 AI, AE-DI2032-G40 Base, AE-DI2032-G4, AE-DI2032-G, AE-DI2032-G6, AE-DI2032-G7, AE-DI2032-G8, AE-DI2032-G9, AE-DI2032-G40(XX), AE-DI2032-G40S, AE-DI2032-G40s, AE-DI2032-G40 L, AE-DI2032-G40 P, AE-DI2032-G40 A, AE-DI2032-G40 B, AE-DI2032-G40L, AE-DI2032-G40P, AE-DI2032-G40A, AE-DI2032-G40B, AE-DI2032-XXXXXXXX (X=0-9 or A-Z or / or - or * or blank)
Standard(s) : FCC Rules 47 CFR §2.1091
 KDB 447498 D04 interim General RF Exposure Guidance v01
Date of Receipt: 2022-10-28
Date of Test: 2022-10-29 to 2022-11-03
Date of Issue: 2022-11-04

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.

Parlam Zhan

Parlam Zhan
Laboratory Manager



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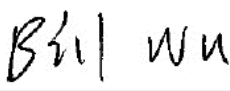
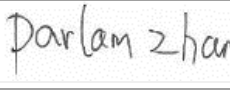
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Revision Record			
Version	Description	Date	Remark
00	Original	2022-11-04	/

Authorized for issue by:			
			
		<u>Bill Wu/Project Engineer</u>	
			
		<u>Parlam Zhan /Reviewer</u>	



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3 General Information

3.1 General Description of E.U.T.

Power supply:	DC 12V
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3.2 Details of E.U.T.

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:	Chip Antenna
Antenna Gain:	1.72 dBi (Provided by manufacturer)

2G

Testing frequency band:	Band	Tx (MHz)	Rx (MHz)
	GSM850	824 - 849	869 - 894
	PCS1900	1850 - 1910	1930 - 1990
Type of Modulation:	GMSK(GSM/GPRS/EGPRS), 8PSK (EGPRS)		
Sample Type:	Fixed equipment		
Antenna Type:	FPC Antenna		
Antenna Gain:	GSM850: Main Antenna:-2.06dBi Div Antenna: 0.70dBi GSM1900: Main Antenna:1.44dBi Div Antenna: 2.12dBi		

3G

Testing frequency band:	Band	Tx (MHz)	Rx (MHz)
	BAND II	1850 - 1910	1930 - 1990
	BAND V	824 - 849	869 - 894
Type of Modulation:	UL QPSK,16QAM DL QPSK,16QAM		
Sample Type:	Fixed equipment		
Antenna Type:	FPC Antenna		
Antenna Gain:	WCDMA BAND II: Main Antenna:1.44dBi Div Antenna: 2.12dBi WCDMA BAND V: Main Antenna:-2.06dBi Div Antenna: 0.70dBi		

4G

Frequency Band:	LTE	Duplex	Uplink (MHz)	Downlink (MHz)	Supported Channel Bandwidth					
	BAND	Mode			1.4	3	5	10	15	20
	2	FDD	1850 - 1910	1930 - 1990	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	4	FDD	1710 - 1755	2110 - 2155	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	5	FDD	824 - 849	869 - 894	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	---	---
	28	FDD	703 - 748	758 - 803	---	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	66	FDD	1710 - 1780	2110 - 2180	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Type of	UL: QPSK,16QAM									



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Modulation:	DL: QPSK,16QAM
Sample Type:	Fixed equipment
Antenna Type:	FPC Antenna
Antenna Gain:	Band 2: Main Antenna:1.44dBi Div Antenna: 2.12dBi Band 4: Main Antenna:0.90dBi Div Antenna: 2.68dBi Band 5: Main Antenna:-2.06dBi Div Antenna: 0.70dBi Band 28: Main Antenna:-2.47dBi Div Antenna: -1.86dBi Band 66: Main Antenna:1.91dBi Div Antenna: 2.68dBi

Note:

The antenna gain value is provided by the customer. The test lab will not be responsible for wrong test result due to incorrect information about antenna gain values.

3.3 Separation Distance

Separation distance between the antenna to person (R):	>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.	



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3.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. E&E Lab

588 West Jindu Road, Xinqiao, Songjiang, 201612 Shanghai, China.

Tel: +86 21 6191 5666

Fax: +86 21 6191 5678

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).

3.5 Test Facility

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

• **CNAS (No. CNAS L0599)**

CNAS has accredited SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. 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. 6332.01)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. is accredited by the American Association for Laboratory Accreditation(A2LA).

• **FCC (Designation Number: CN1301)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been recognized as an accredited testing laboratory.

• **ISED (CAB Identifier: CN0020)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. EMC Laboratory has been recognized by Innovation, Science and Economic Development Canada (ISED) as an accredited testing laboratory.

Company Number: 8617A

• **VCCI (Member No.: 3061)**

The 3m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-13868, C-14336, T-12221, G-10830 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 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.



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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	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 $\lambda/4$.

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.

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).



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

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	0.7	1.299	20	1428.000
1.5~6	2.462	1.903	20	3060.000



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5 Measurement and Calculation

5.1 Maximum transmit power

2G/3G/4G

The power for modular SIM7600SA-H refer certificate of FCC ID: 2AJYU-8PYA002

Frequency Band	Highest Averaged Power Output(dBm)	Highest Frame-Averaged Output Power (dBm)	Antenna Gain(dBi)
GSM850	35	25.97	0.70
GSM1900	32	22.97	2.12
WCDMA Band2	25	25	2.12
WCDMA Band5	25	25	0.70
LTE Band 2	25.7	25.7	2.12
LTE Band 4	25.7	25.7	2.68
LTE Band 5	25.7	25.7	0.70
LTE Band 28	25.7	25.7	-1.86
LTE Band 66	25.7	25.7	2.68

Notes:

1) Division Factors

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

2) According to the conducted power as above, the measurements are performed with 1Txslots for 850MHz and 1900MHz.

For 2.4G WiFi

The Power Data is based on the RF Test Report SHCR221000232301.

Test Mode	Antenna	Channel	Result [dBm]	Result [mW]
11B	Ant1	2412	16.40	43.65
		2437	16.57	45.39
		2462	15.93	39.17
11G	Ant1	2412	12.54	17.95
		2437	12.73	18.75
		2462	12.24	16.75
11N20SISO	Ant1	2412	12.49	17.74
		2437	12.77	18.92



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		2462	12.26	16.83
11N40SISO	Ant1	2422	11.05	12.74
		2437	11.22	13.24
		2452	11.31	13.52

5.2 RF Exposure Calculation

For 2.4G WiFi

The Max Conducted Peak Output Power is 45.39mW. The best case gain of the antenna is 1.72dBi.

1.72dBi logarithmic terms convert to numeric result is nearly 1.49

According to the formula. calculate the EIRP test result:

$$EIRP = P \times G = 45.39 \text{ mW} \times 1.49 = 67.63\text{mW}$$

For 2G/3G/4G

Frequency Band	Results(mW)	Limit(mW)	Verdict
GSM850	464.52	1428	Pass
GSM1900	322.85	3060	Pass
WCDMA Band2	515.23	3060	Pass
WCDMA Band5	371.54	1428	Pass
LTE Band 2	605.34	3060	Pass
LTE Band 4	688.65	3060	Pass
LTE Band 5	436.52	1428	Pass
LTE Band 28	371.54	1428	Pass
LTE Band 66	688.65	3060	Pass

The 2.4G WiFi&GSM/WCDMA/LTE can simultaneous transmitting. But the maximum rate of MPE is =
67.63mW + 464.52 mW = 532.15mW <1428mW, 67.63mW + 688.65 mW = 756.28mW <3060mW.

Remark 1: we used the maximum power between the conducted power and ERP/EIRP to perform RF exposure exemption evaluation.

Remark 2:Frequency follow in 0.3GHz~1.5GHz limit was 2040f (0.3GHz≤f<1.5GHz),we used the worst 1428mW (f=0.7)limit to evaluation.

	Evaluation method	Exempt Limit(mW)	Verdict
<input type="checkbox"/>	Blanket 1 mW Blanket Exemption	1mW	N/A
<input type="checkbox"/>	MPE-based Exemption(ERP)	7mW(ERP) (2.4GHz Band)	N/A
<input checked="" type="checkbox"/>	SAR-based Exemption(P_{th})	1428mW(ERP) (0.3GHz~1.5GHz)	Yes
<input checked="" type="checkbox"/>	SAR-based Exemption(P_{th})	3060mW(ERP) (1.5GHz~6GHz)	Yes



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

--End of the Report--



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